United States Department of Agriculture

Natural Resources Conservation Service

Supplement to the Soil Survey of Santa Clara Area, California, Western Part

National Cooperative Soil Survey

This document was made for the National Cooperative Soil Survey by the United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Regents of the University of California, Agriculture and Natural Resources (Agricultural Experiment Station); the Guadalupe-Coyote Resource Conservation District; the Mid-Peninsula Regional Open Space District; the Santa Clara County Parks and Recreation Department; the Santa Clara County Open Space Authority; and Stanford University. This supplement accompanies the most current official data for the soil survey of the Santa Clara Area, California, Western Part, available at http://websoilsurvey.nrcs.usda.gov/app/.

Acknowledgement is also given to the many cities and towns within the survey area who granted permission for the soil survey to be conducted on their public lands. These include Campbell, Cupertino, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Mountain View, Palo Alto, Santa Clara, San Jose, Saratoga, and Sunnyvale.

This document is part of the technical assistance furnished by the Natural Resources Conservation Service, Hollister, California Office to the Guadalupe-Coyote Resource Conservation District.

Literature Citation

The correct citation for this survey is as follows:

United States Department of Agriculture, Natural Resources Conservation Service. 2015. Supplement to the Soil Survey of the Santa Clara Area, California, Western Part. (Accessible online at: http://soils.usda.gov/survey/printed_surveys/)

Cover Caption

View looking southeast across the cities of the Santa Clara Valley to the Diablo Ranges and Santa Cruz Mountains. Photo courtesy NASA Ames Research Center, Moffett Field, California. Photo circa 1995.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov/.

Nondiscrimination Statement

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases will apply to all programs and/or employment activities.)

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by email to program.intake@usda.gov or by mail to:

USDA
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, S.W.
Washington, D.C. 20250-9410

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Contents

Issued 2015

Preface

This document is intended to provide additional information about the survey of the Santa Clara Area, California, Western Part, that is not provided in the Web Soil Survey SSURGO data.

This supplement and the online soil survey data provide information that affects land use planning in this survey area. They are intended for many different users. Farmers, ranchers, foresters, and agronomists can use the information to evaluate the potential of the soil and the management needed for maximum food and fiber production. The information can be used by planners, community officials, engineers, developers, builders, and home buyers to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. It can also be used by conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control to help them understand, protect, and enhance the environment.

Location of Santa Clara Area, California, Western Part

Supplement to the Soil Survey of Santa Clara Area, California, Western Part

Narratives written by William Reed, natural resources specialist, Natural Resources Conservation Service

Technical editing by Christopher “Kit” Paris, soil data quality specialist, Natural Resources Conservation Service

This document was developed to support and supplement the data for the soil survey of Santa Clara Area, California, Western Part. The data and maps for this soil survey have been previously published for the Soil Survey Geographic Database (SSURGO) via the Web Soil Survey online application. Report tables, interpretations, detailed map unit descriptions, and maps can be accessed using the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/). Data can be downloaded using the Geospatial Data Gateway (http://datagateway.nrcs.usda.gov/).

This document provides information not available through Web Soil Survey. It contains narrative descriptions of the physiography, geology, relief, climate, drainage, and formation of the soils in the survey area and includes applications of the soil survey for the urban environment. In addition, it provides the taxonomic descriptions of the soils along with photographs of soil profiles and landscapes.

This survey updates portions of the soil survey of Santa Clara Area, California published in 1958 (USDA-SCS) and the supplemental report “Soils of Santa Clara County” published in 1968 (USDA-SCS). The new soil survey is fully digital with a new soil property database and digital soil maps, available on the Web Soil Survey.

The new survey covers the northwestern part of Santa Clara County and joins the soil survey of Eastern Santa Clara Area (published in 1974), which covers the rest of Santa Clara County. The survey area also borders San Mateo County, Santa Cruz County, and Alameda County. The total acreage of this new survey is 315,658.

General Nature of the Survey Area

This section provides general information about the physiography, relief, and drainage; major land resource areas; history and development; and climate of the survey area.

Physiography, Relief, and Drainage

The survey area is a portion of northern California located at the southern end of the San Francisco Bay. The entire area is part of the Coast Ranges of California.

The Santa Clara Valley

The Santa Clara Valley is a structural valley formed by mountain building in the Santa Cruz Mountains and the Diablo Ranges. Natural erosion in the mountains has

Figure 1.—View of the tidal marshes looking northwest from Monument Peak.

deposited alluvium along streams at the margins of the foothills, building extensive alluvial fans. Urbanization of the valley has covered the landforms, making them difficult to identify. Streams have been altered and controlled. The valley starts in Palo Alto, continues southeast to the south end of San Jose, and then continues south beyond the survey area.

The marshes of the San Francisco Bay occur in the northern part of the survey area and include the tidally flooded marshes adjacent to the waters of the bay (fig. 1). Diurnal tides flood these marshes, except where they are protected by levees. Elevation ranges from 0 to about -6 feet in protected areas due to subsidence. The soils are saturated to the surface and are very poorly drained. Locally, the soil material of the marshes is known as bay mud. Bay mud soils are severely limited by reduced soil strength and compressibility, are saline and sodic, and are potential acid sulphate soils. In many areas, levees have been constructed to pond salt brine for salt production. Currently, these soils are used for wildlife habitat and are planned for restoration to tidal marsh.

Basins occupy the lowest part of the valley. Drainage was internal under natural conditions but has been artificially improved by pumping ground water and controlling flooding. Elevation ranges from 0 to 600 feet, and slopes are 0 to 2 percent. Basins are in lower Palo Alto, Mountain View, Sunnyvale, Santa Clara, and south San Jose. They are extensive in the lower part of the valley. Streams from the mountains and foothills cross the basin, typically in straight altered channels. Some have levee systems for flood control.

Lower alluvial fans and flood plains are also extensive at elevations slightly higher than those of the basins. They cover large areas of the valley. Elevation ranges from 0 to 545 feet, and slopes are 0 to 2 percent. Streams from the mountains and

foothills have been channelized and straightened to some degree, and levee systems have been established along some of the lower flood plains. Under natural conditions, these lower alluvial fans and flood plains were regularly flooded, and the deposited materials resulted in very productive soils. Most of this area has been densely urbanized.

The upper alluvial fans occur along both sides of the valley and are below the foothills and terraces. Elevation ranges from 20 to 835 feet. Slopes range from 0 to 30 percent, and most are less than 15 percent. Under natural conditions, streams from the mountains and foothills deposited large amounts of the alluvium that helped build these upper fans. Because this area is closer to the mountains, the stream load included more fragments and led to soils that are commonly gravelly in the subsoil and substratum. The streams have been controlled by upstream structures and by channelization so that flooding does not occur across most of the area. Most of this area has been urbanized, mostly for residential use.

The highest part of the valley is the terraces. The terraces occur just below the foothills of the Santa Cruz Mountains and, to a much smaller extent, below the foothills of the Diablo Ranges. Originally, they were alluvial fans; they have been elevated by geologic uplift and eroded into rolling hills over a long time. Some areas near the base of the Santa Cruz Mountains have been elevated more and eroded into sharp ridges that bear little resemblance to an alluvial terrace but are nonetheless constructed of alluvium. Elevation ranges from 70 to 1,285 feet. Slopes range from 15 to 65 percent; the steeper slopes are on the sharper ridges. Larger streams draining the area have almost cut through to the base of the terraces; smaller streams drain the hills. The lower areas are rolling and have been urbanized for residential use, and the steeper areas have some homesites. Much of the area is used for recreation and wildlife habitat.

Foothills of the Santa Cruz Mountains and the Diablo Ranges

The foothills of the Santa Cruz Mountains and the Diablo Ranges are part of the Franciscan Formation and are constructed of shale and sandstone (fig. 2). Elevation ranges from 30 to 1,900 feet, and slopes are 5 to 50 percent. Streams and terraces separate areas of foothills. The largest areas are in the Diablo Ranges; the Santa Cruz Mountains have a more abrupt rise from the terraces. Some streams in the Diablo Ranges have cut deeply into the foothills, especially Penitencia Creek in Alum Rock Park where the cut is as much as 1,200 feet and hot springs are exposed along the creek. Many areas have a rolling to steep topography and fine textured soils. Located mostly in the southeast part of the survey area are the foothill areas of serpentinite. These areas have rock outcrops of serpentinite and unique plants that thrive in soils with a high content of magnesium. Some areas of the foothills are used for homesites, others for recreation and wildlife habitat, and others in the Diablo Ranges for cattle grazing. Grass and oak are the dominant vegetation, although brush and poison oak cover some areas near the Santa Cruz Mountains and the north slopes in the Diablo Ranges.

Santa Cruz Mountains

These mountains stretch across the western and southern parts of the survey area. Elevation ranges from about 1,000 feet to more than 3,790 feet (at the summit of Loma Prieta). Slopes range from 8 to 100 percent. In many areas, the mountains rise abruptly from the foothills and terraces. Rainfall amounts increase sharply with altitude: the brush and grass of the lower slopes receive 25 to 30 inches of rainfall annually, the forest vegetation receives more than 40 inches at 2,000 feet, and areas above have up to more than 50 inches (at about 3,000 feet). The massive San Andreas Fault system slices through the Santa Cruz Mountains from northwest to southeast.

Figure 2.—View of the Santa Clara Area looking southwest from the Diablo Ranges.

Due to the horizontal displacement of hundreds of miles on the west side of the fault, there is a dramatic change in geology and soils from one side of the fault to the other. On the east side of the fault is the Franciscan Formation with sandstone, shale, and greenstone. Across the fault to the west is sandstone and shale. These materials are more easily weathered and produce deeper soils that support dense forests of Douglas fir, California bay laurel, tanoak, madrone, and poison oak. Major streams follow the San Andreas Fault line: Stevens Creek runs southeast along the fault before turning east to exit the mountains and Los Gatos Creek runs northeast along the fault before turning north to exit at Los Gatos. Unique geologic areas include the historic mercury mining area of New Almaden south of San Jose and deposits of limestone on Black Mountain west of Cupertino. A large portion of the Santa Cruz Mountains is used for recreation, wildlife habitat, and watershed. County parks and open space are extensive, and some areas have homesites.

Diablo Ranges

Only a small portion of the Diablo Ranges is in the soil survey area (fig. 3). It stretches from the upper foothills to the top of the watershed facing the Santa Clara Valley, forming the eastern boundary of the soil survey area. Elevation ranges from about 1,000 feet to 2,400 feet (on Monument Peak). Slopes range from 9 to 75 percent. Streams generally drain the area flowing to the west, except for Silver Creek in the southeastern part of the survey area, which flows north. Annual rainfall ranges from 25 to 30 inches. Sandstone and shale of the Franciscan Formation make up most of the area. Vegetation is grass and oak with some brush and poison oak on north slopes. Land use includes county parks, open space, cattle grazing, and homesites with spectacular views of the Santa Clara Valley.

Major Land Resource Areas

The United States Department of Agriculture Handbook 296, “Land Resource Regions and Major Land Resource Areas of the United States,” provides a basis for making decisions about national and regional agricultural concerns, identifies needs for research and resource inventories, provides a broad base for extrapolating the results of research within national boundaries, and serves as a framework for organizing and operating soil surveys and resource conservation programs.

Major land resource areas (MLRAs) are geographically associated land resource units. Land resource regions are groups of geographically associated major land resource areas. Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional, and national planning. The soil survey area is within three MLRAs: the Coastal Redwood Belt (MLRA 4B), the Central California Coastal Valleys (MLRA 14), and the Central California Coast Range (MLRA 15).

MLRA 4B is a small part of the soil survey area in the Santa Cruz Mountains along the western boundary with Santa Cruz and San Mateo Counties. Elevation ranges from about 2,000 to 3,400 feet. Slopes are steep except along ridges. Vegetation is dominantly Douglas fir and tanoak. Earlier logging removed a lot of the redwoods; the remaining redwoods occur mostly along streams as single trees or small groves. Some redwoods also occur on north slopes. MLRA 4B ends rapidly east from of the soil survey boundary where there is a drop in elevation and rainfall. Annual rainfall ranges as high as 60 inches and rapidly drops to about 40 inches on the eastern margins of the MLRA, at an elevation of about 2,000 feet. Mean annual air temperature ranges from 55 to 59 degrees F, and the frost-free period is 200 to 250 days. Geology is sandstone and shale, and most of the area is near or west of the San Andreas Fault.

Figure 3.—View of a typical area within the Diablo Ranges of the Santa Clara Area.

Soils are mainly Ben Lomond and Aptos; Felton and Casrock soils occur to a lesser extent. Soil temperatures are mesic. Land use is varied and includes open space, State and county parks, homesites, vineyards, and Christmas tree farms.

MLRA 14 covers the Santa Clara Valley and small valleys along streams extending into the foothills of the Santa Cruz Mountains and the Diablo Ranges. In the survey area, most of these valleys have been extensively urbanized. Small areas are preserved as parks and open space. The major cities of San Jose, Milpitas, Sunnyvale, Mountain View, and Palo Alto are all in MLRA 14 along with smaller cities and towns. This continuous urban area has a population close to 2 million. Extending out from the foothills of the Santa Cruz Mountains and the Diablo Ranges are terraces, then gently sloping alluvial fans that terminate at basins. Native vegetation is oaks, grasses, and forbs with some shrubs. Elevation ranges from about 400 feet to sea level. Many areas of the MLRA have undergone subsidence due to the historic overdrafting of ground water for crop irrigation in the decades prior to urbanization. Annual precipitation ranges from about 14 to 24 inches. Mean annual air temperature range from about 57 to 61 degrees F, and the frost-free period is about 275 to 325 days. Soils are very deep with high natural fertility and a good water-holding capacity. Flaskan and Botella soils occur on alluvial fans and are very productive for gardens and urban plantings. The basin soils Hangerone and Clear Lake are also very fertile but have clay textures. These soils naturally had water tables but have been drained with the overall drainage of the valley.

MLRA 15 includes the Diablo Ranges on the eastern side of the Santa Clara Valley and the Santa Cruz Mountains and foothills. Urban development has extended into the less sloping areas of the foothills near the Santa Clara Valley. The mountains have steep slopes that rise up sharply from the foothills. This portion in the Santa Cruz Mountains has dense vegetation of brush, oaks (such as poison oak), and some grasses. The geology of the Santa Cruz Mountains is the Franciscan Formation east of the San Andreas Fault where greenstone and sandstone are dominant. The geology of the Diablo Ranges is the Franciscan Formation where sandstone and shale are dominant. Vegetation is oaks and grasses with some shrubs on north slopes. Elevation ranges from about 400 feet at the base of the foothills to about 3,500 feet in the Santa Cruz Mountains and about 2,600 feet in the Diablo Ranges. Annual precipitation ranges from about 20 to 50 inches in the Santa Cruz Mountains and from about 16 to 20 inches in the Diablo Ranges. Mean annual air temperatures range from 55 to 59 degrees F in the Santa Cruz Mountains and from 57 to 61 degrees F in the Diablo Ranges. The frost-free period ranges from 200 to 275 days in the Santa Cruz Mountains and from 250 to 275 days in the Diablo Ranges. There is a wide range of soils in the Santa Cruz Mountains: south slopes have shallow soils, such as Maymen and Sanikara, and north slopes have deeper soils, such as Footpath and Mouser. In the Diablo Ranges, Vertisols, such as Altamont, Alo, and Diablo, occur at the lower elevations and Maymen and Gaviota soils occur on steep slopes. The Diablo Ranges are used for homesites and cattle grazing. Many other areas are parks and open spaces. The Santa Cruz Mountains are mostly open space and parks with some areas used as homesites.

History and Development

Native American Era

Archeological discoveries have placed the earliest record of Native Americans in the Santa Clara area at between 11,000 and 9,500 years ago. A relatively limited number of discovered sites are dated prior to about 5,000 years ago; after that, the number of sites begins to increase. A good deal of the discovered sites are located in buried soils, older stable surfaces that were covered with alluvium during the Holocene Epoch. The survey area, because of its abundant natural resources, probably could support a large

population of hunter-gathers. There were an estimated 10,000 Native Americans living in the Bay Area at the time of the Spanish expansion north from Mexico in 1769, and it is reasonable to assume there was a large population living in the Santa Clara area.

Life for the early Native Americans—the Ohlone people—consisted of hunting game such as elk and bear and smaller animals. Fish and clams were obtained from the bay. There were acorns from the abundant oaks, berries, and other edible plants. The Ohlone diet was varied and nutritious. Trading occurred with other tribes in the area along with intermarrying. Society was organized with a chief and his family in control over the resources of the tribe. After death, many of the native people were interned in shell mounds. These mounds contained charcoal and other artifacts. They were first thought to be village sites but were later discovered to be places of extended ceremonial encampment. The shell mounds in the northern Santa Clara Valley have been destroyed by agriculture and urbanization.

Mission Period

In 1769, Spanish explorers and monks arrived in California. Spain was a major colonial power at this time and was expanding into California, to search for legendary riches and colonies and to establish military outposts known as presidios and missions. The missions had a mix of Spanish soldiers and monks. Jose Francisco Ortega scouted the region around Santa Clara and gave it a new name—Llano de los Robles, or Plain of the Oaks. First encounters with the Ohlone were peaceful and respectful. The good stature and robust health of these people indicated the good healthy life available in this area of abundant natural resources and mild climate. The Spanish recorded the luxuriant plant life in the valley, a testament to the extremely productive local soils.

In 1777, Father Junipero Serra established a mission at Santa Clara, the Mission Santa Clara de Asis. The town of San Jose was also started that same year by Spanish soldiers. It was the first town in California. The missions were established to obtain a presence in California after Russians had come from the north and settled in the Fort Ross area. The Ohlone people were treated poorly by the soldiers and monks at the missions. The native people were brought to the mission against their will in a forced assimilation into European culture and economy. Native Americans built the missions and presidios and ran the farms and ranches of the missions. Resistance to the Spanish developed quickly among the Native American tribes. Due to the poor living conditions and poor treatment, populations of the Ohlone decreased rapidly: there were only an estimated 2,000 in the Bay Area and Monterey area by 1810. Another major factor in their decline was the European diseases to which they had little or no resistance. The mission period lasted 44 years in Santa Clara. It ended in 1821 when Mexico revolted against Spain and California became part of Mexico.

Mexican Period

Major changes were made by Mexico when it took control of Alta California, as it was known, from the Spanish. A process of secularization was begun in 1834 to take the extensive landholdings from the missions and return them to the people. Unfortunately, most of these lands went to the highest bidder. Native Americans received some small plots of land that were not sufficient to live on and in some instances were cheated out of their land. Native Americans and others at the missions were set free, and most left.

The Mexican government also distributed large blocks of land as land grants to individuals. At least 18 of these land grants were distributed to individuals in the northwestern part of Santa Clara and consisted of more than 150,000 acres covering most of the northern Santa Clara Valley. These ranchos, as they became known, ranged in size from about 2,000 to 35,000 acres. Ranchos farmed and raised cattle, mostly for hides and tallow. Cattle roamed free without fences and were rounded up

by vaqueros in the spring. They were mostly owned by wealthy Mexicans. Labor was provided by the Ohlone people who left the missions, and their fare was not much better on the ranchos than on the missions. Only seven Ohlone people received land from the breakup of the missions, the rest became rancho workers or left the area to rejoin inland tribes.

Although population remained low (about 14,000 permanent residents were in California in 1845) conflict between the ranchos and Native Americans continued to escalate in the 1840s. At this time, diseases ran rampant through the native populations and epidemics greatly reduced their numbers. The Native American population in California declined from an estimated 1.5 million prior to 1769 to about 100,000 in 1845.

The Mexican-American War ended in 1846. In 1848, Mexico ceded California to the United States for 15,000,000 dollars and California became a territory.

United States

Santa Clara County was one of the original counties established in California when it became a State in 1850. Its population was very low. San Jose was the second incorporated city after Sacramento and was the State Capitol in 1850 and 1851. The discovery of gold in 1849 at Sutter's Mill dramatically altered conditions in California. Thousands of people poured into the State looking for gold. Although not on the main track to the gold fields from San Francisco, San Jose became a supply town for the miners.

The New Almaden quicksilver mine was started by Captain Andres Castillero of the Mexican military. Captain Castillero had been led to the site in 1845 by the Ohlone, who collected the cinnabar for paint and trading. After obtaining a mineral claim with the Mexican government, Captain Castillero began mining. The Barron Forbes Company took over the mining operations in 1846 and continued the mining until 1863, when ownership changed again. After the discovery of gold, the mining operations expanded rapidly to supply gold miners with mercury, which was used to extract gold from crushed rock. The mines grew to substantial size with shafts extending for miles and down to 2,300 feet below the mountain. Population increased at the mines. In 1865, there were 1,800 residents and 700 structures at the mine. One interesting fact about the New Almaden quicksilver mine is that there were no individual gold mines in California that earned as much as the New Almaden mine did mining mercury. The mines operated until the late 1800s then began to decline. The area became a county park in 1976. The New Almaden mine produced more mercury than any mercury mine in California.

There were many land ownership issues to be settled when the United States took over California. The ranchos, which were land grants from the Mexican government, were being broken up and sold in small parcels. Many people had trouble determining title to the land, and many court battles ensued. These issues continued until sometime around 1880, when most had been settled. This allowed the land to be sold as even smaller parcels, especially when the value soared for land used as orchards.

Wheat Era (1850s to 1880s)

In the early 1850s, farmers in the Santa Clara Valley began planting dry-farmed wheat in response to the need for food for the gold miners and the increasing population of California. The farmers soon discovered that they could plant a fall crop and then a spring crop. Wheat during this time was purely a cash crop. Large tracts of land were used to produce the wheat, and farm machinery such as gang plows and reapers was needed. Several foundries started to manufacture this farm equipment in San Jose as early as 1852. The equipment was shipped to other farming areas of California (Jacobson, 1984). In 1864, the San Francisco and San Jose Railroad opened. It could transport produce from San Jose to the larger city of San Francisco.

The Santa Clara Valley became a major producer of strawberries with the use of water from artesian wells for irrigation.

As many as 10 grist mills ground the wheat grain into flour, which was transported mostly by ship from the town of Alviso to San Francisco and exported from there to markets (Jacobson, 1984). In the mid-1870s, wheat production reached 1.7 million bushels and almost 185,000 acres of the Santa Clara Valley were planted in grains and hay (Jacobson, 1984). When Santa Clara County was linked to the transcontinental railroad system in 1869, grain was shipped across the Nation. Santa Clara County farmers were no longer limited to markets nearby.

The amazing fertility of the Santa Clara Valley was evident to many and recognized in 1868 by John Muir, who noted the production of grains, orchards, and vineyards. The valley was covered with farms that all produced high-quality crops, some through the use of irrigation. The production of wheat began to decline in the 1880s in response to several factors: land prices became too high for the large acreages required to produce grains successfully, the Midwest States began to produce cheaper wheat, and some lands began to have nutrient deficiencies due to extended grain production. In addition, erratic rains in fall and spring in Santa Clara were problematic for rain-fed crops.

Orchard Era (1880s to 1960)

Many had noticed over the years that orchard crops from the farms of the fertile Santa Clara Valley were of unusually high quality. Deep fertile soils and the gentle climate produced beautiful fruit. An industry of international acclaim grew out of the orchards in the Santa Clara Valley. Fruit was iced and shipped by railroad to markets in the eastern United States, and some products were shipped overseas.

E.L. Bradley demonstrated in the early 1880s that an unirrigated prune orchard of 10 acres could produce enough income for a family to live on. A land rush ensued in which large parcels of land were subdivided into small acreages for orchards (Jacobson, 1984). Farms of 20 to 30 acres, which could easily support a family, were not unusual (Jacobson, 1984).

Before about 1900, most orchards were dry farmed with sufficient production to make a profit. With the development of mechanical pumps powered by electricity or gas engines, irrigation increased the quality and quantity of fruit produced in the orchards. The pumping of ground water increased across the valley and eventually lowered the ground water levels, a process that continued throughout the orchard era and into the 1960s. With the water extraction, the land began to subside across a large area of the Santa Clara Valley and southern San Francisco Bay. Pipes underground broke as the land subsided unevenly. Dikes had to be erected around the bay margins to keep the bay from flooding farmland and Alviso. Water tables that had been close to the surface dropped to several hundred feet, and the artesian wells became a thing of the past. By 1914, most of the 45,000 irrigated acres were irrigated with pumps (Jacobson, 1984).

Due to concerns raised by farmers and business leaders, the Santa Clara Valley Water Conservation District was formed in 1929. The district began an ambitious plan to erect dams on major creeks so that stream flow and flood control could be managed and water could be stored to resupply ground water. By 1936, Almaden, Calero, Coyote, Guadalupe, Stevens Creek, and Vasona Reservoirs were completed and recharging of the aquifers started. These reservoirs were effective at reducing flooding in some areas; however, subsidence continued due to the amount of irrigation water that was being pumped for the orchards and row crops. Subsidence was finally stopped in the late 1960s after most of the cropland was converted to urban uses and water was imported from the delta, but this was well after most of the orchards were gone.

San Jose during the period of the orchards grew into the largest cannery and dried fruit packing center in the world. In 1939, San Jose had 18 canneries, 13 dried fruit packing houses, and 12 fresh fruit and vegetable shipping firms.

El Camino Real was originally a dirt road lined with orchard trees running between Palo Alto and San Jose and south to Gilroy. In 1913, paving improved transportation by truck of fresh produce to local markets. Fruit was shipped via railroad from San Jose to points around the Nation.

In the 1920s, the number of farms peaked at nearly 7,000 and there was an all-time record of 132,000 acres planted in fruits, nuts, and vineyards (Jacobson, 1984). The way of life developed on the small orchard farms, a life of family and hard work, lasted until about 1950. The Santa Clara Valley began to change into an urban area with a massive influx of new residents.

By 1960, farm acreage declined by a third from its peak and farm ownership declined by two thirds. By 1978, only 1,427 small farms remained on 21,000 acres (Jacobson, 1984).

Silicon Valley

The transition of the scenic fruit-tree-studded Santa Clara Valley into a major urban center began in the early 1950s. Stanford University played a major role: Dr. Fred Terman of the Electrical Engineering Department established the Stanford University Industrial Park along Page Mill Road. Companies were started to research and develop semiconductors. Many companies started in nearby towns, such as Mountain View and Sunnyvale. Larger established firms eventually moved into the valley as the industry grew. Many new companies formed, or established companies moved operations to the area. Sunnyvale had more than 600 high-tech firms in the 1980s. Some of the earliest major firms were Fairchild Semiconductor, Westinghouse Electric, National Semiconductor, IBM, and Lockheed. A little later, Apple, Intel, Adobe, and Google were formed. Many of these companies are known worldwide.

The computer industry was born. The resulting growth eventually spread to the entire valley. All the smaller towns expanded to form a metropolis spreading from Palo Alto on the west to Milpitas on the east.

Population growth was nothing short of spectacular. Santa Clara County had a population of 291,000 in 1950; 652,000 in 1960; 1,125,000 in 1970; 1,480,000 in 1980; 1,682,585 in 1990; and 1,764,499 in 2008. Most of the valley floor was densely developed by 1990, and subdivisions spread out to the base of the foothills.

The development and manufacture of computers and their components and the subsequent growth of Internet companies have continued the growth of Silicon Valley.

Climate

The climate of the northwestern part of Santa Clara County in the Santa Clara Valley is shielded from extremes of wind, rain, and temperature. The protecting influence of the Santa Cruz Mountains to the west and south and the Diablo Ranges to the east deflect harsh weather from the area. The San Francisco Bay also moderates the climate by cooling warm afternoons in summer and early fall with breezes and limiting the temperature drop on cold nights during late fall and winter. San Jose has on average only 18.3 days a year with a temperature above 90 degrees F. Winter nighttime temperatures drop below 32 degrees F an average of only 4.6 nights per year.

Heat waves do occur nearly every year when the cooling winds originating on the Pacific Ocean are blocked by winds coming from the east and northeast. These offshore wind situations, however, are usually short, lasting only 3 days or less before the cooling breezes return.

Table 1 gives data on temperature and precipitation for the survey area as recorded at San Jose in the period 1971 to 2000. Table 2 shows probable dates of the first

freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 51.0 degrees F and the average daily minimum temperature is 42.4 degrees. The lowest temperature on record, which occurred at San Jose on December 22, 1990, is 19 degrees. In summer, the average temperature is 69.3 degrees and the average daily maximum temperature is 81.8 degrees. The highest recorded temperature, which occurred at San Jose on June 14, 2000, is 109 degrees.

Growing degree days are shown in table 1. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall. In most years temperatures do not drop below 28 degrees F. This allows the growth of some subtropical plants, such as jacaranda (*Jacaranda mimosifolia*).

The average annual total precipitation is 14.93 inches. Rainfall occurs mostly from November to April. The other months are much drier, and the summer months are virtually rain free with clear skies. Rain falls on average about 50 days a year in San Jose. The variability of rainfall from year to year is rather large, from 6.12 to 32.57 inches. During dry years, high pressure in the Pacific Ocean tends to block weather fronts from reaching the survey area. During the wettest years, storms flow regularly through the area. Some are related to the Pacific phenomenon known as El Niño.

Snowfall is extremely rare in the San Jose area. The greatest snow depth at any one time during the period of record was 1 inch, recorded on January 21, 1962. The heaviest 1-day snowfall on record was 0.5 inch, recorded on February 5, 1976. Snowfall is spotty in the valley: some areas may receive none and others may get 1 to 2 inches during the same weather event. Thunderstorms are rare but can occur after the passage of a strong cold front. Tornadoes are virtually unknown to the area.

The sun shines more than 280 days a year at San Jose. The prevailing wind is from the northwest, especially during the summer months. Southeast winds can occur occasionally during summer and do occur during winter rain events. Humidity is high during the winter rainy season but drops during the summer and fall, thus reducing the effects of high temperatures.

As is common with most of the San Francisco Bay area, there are microclimates within the northern Santa Clara Valley area. Areas along the bay are cooler in summer than San Jose because of the cool northwest breezes coming from the bay. Areas such as Los Gatos, Saratoga, and Los Altos Hills are shielded from most winds by the foothills.

The Santa Cruz Mountains have a climate that differs from that of the Santa Clara Valley. Rainfall increases with elevation, exceeding 50 inches a year above 2,500 feet. Rainfall events can be heavy as winds from the Pacific Ocean are lifted over the mountains. Winds can be damaging during winter storms, especially to exposed ridges. High wind events occasionally occur in late summer or early fall due to atmospheric pressure differences and can be damaging and create very severe fire hazards.

Snowfall occurs in most years at elevations above 2,000 feet. It usually is only a few inches thick and does not last more than a few days.

Temperatures are colder in the mountains due to elevation but are moderated somewhat by close proximity to the Pacific Ocean, which generally has a water temperature of about 50 degrees during the winter months. Freezing temperatures do occur regularly during the winter months on clear nights. Summer temperatures typically are moderate; however, when areas are above the marine layer, temperatures can be high.

Table 1.—Temperature and Precipitation

(Recorded in the period 1971-2000 at San Jose, California)

Month	Temperature (degress F)						Precipitation (inches)				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temp. higher than--	Minimum temp. lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snow-fall
January--	58.4	41.6	50.0	70	29	60	3.03	0.89	4.95	6	0.0
February-	62.4	44.6	53.5	76	32	116	2.78	0.79	4.40	6	0.0
March----	65.9	46.5	56.2	81	36	195	2.59	0.77	4.54	6	0.0
April----	70.5	48.2	59.3	90	39	282	1.02	0.26	1.70	2	0.0
May------	75.1	51.8	63.5	96	42	413	0.44	0.00	0.72	1	0.0
June-----	80.2	55.4	67.8	101	46	529	0.10	0.00	0.14	0	0.0
July-----	82.8	57.5	70.1	101	50	620	0.06	0.00	0.08	0	0.0
August---	82.4	57.6	70.0	99	51	620	0.07	0.00	0.02	0	0.0
September	80.9	56.6	68.7	98	48	562	0.23	0.00	0.34	0	0.0
October--	74.7	52.4	63.5	93	41	418	0.88	0.18	1.58	2	0.0
November-	64.4	45.6	55.0	79	32	161	1.73	0.33	2.91	4	0.0
December-	57.8	41.0	49.4	68	28	55	2.00	0.73	3.29	4	0.0
Yearly:											
Average	71.3	49.9	60.6	---	---	---	---	---	---	---	---
Extreme	109	19	---	104	26	---	---	---	---	---	---
Total	---	---	---	---	---	4,031	14.93	9.97	18.68	31	0.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.—Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at San Jose, California)

Probability	Temperature (degrees F)		
	24 or lower	28 or lower	32 or lower
Last freezing temperature in spring:			
1 year in 10 later than--	---	Jan. 15	Feb. 10
2 years in 10 later than--	---	Dec. 28	Jan. 31
5 years in 10 later than--	---	---	Jan. 0
First freezing temperature in fall:			
1 year in 10 earlier than--	---	Dec. 13	Nov. 26
2 years in 10 earlier than--	---	Dec. 29	Dec. 7
5 years in 10 earlier than-	---	---	Jan. 1

Table 3.—Growing Season

(Recorded in the period 1971-2000 at San Jose, California)

Probability	Daily minimum temperature (degrees F) during growing season		
	Higher than 24	Higher than 28	Higher than 32
	Days	Days	Days
9 years in 10	>365	>365	301
8 years in 10	>365	>365	318
5 years in 10	>365	>365	360
2 years in 10	>365	>365	>365
1 year in 10	>365	>365	>365

Urban Use of Soils

Prior to 1950, as far back as the late 1800s, the Santa Clara Valley was the scene of vibrant and productive agriculture. Field crops were grown on the lower parts of the valley, and orchards spanned from the hills east of Milpitas and San Jose across the valley to Los Altos and Palo Alto. With the introduction of the electric water pump in the early 20th century, irrigation water from the plentiful ground-water supply became readily available on every farm, thus increasing productivity. The Santa Clara Valley became widely known for the production of high-quality orchard fruits, which were shipped by refrigerated railroad cars around the Nation. Dams were constructed on major streams to store irrigation water and control flooding. Because ground water was rapidly pumped from a depth of several hundred feet, subsurface materials compacted and led to land subsidence. Subsidence damaged pipes and other structures in the ground, and levees were required to block tidewater from entering subsided land. The positive aspect of the control of streams and pumping of ground water was a valley relatively free from flooding and high ground water, an ideal condition for the rapid urban expansion that followed.

After World War II, urban growth in the San Francisco Bay area began to expand down to the south end of the bay and into the Santa Clara Valley. Subdivisions began to spring up as the development pace quickened after 1950. The first wave of development occurred on the soils along the El Camino Real corridor, where the alluvial fans were relatively level with slopes of 0 to 2 percent. Development exploded in the 1960s when the county population increased from 652,300 (in 1960) to 1,125,000 (in 1970). Construction grading equipment moved relatively small amounts of the topsoil as streets were slightly excavated and house foundation areas were slightly raised. Much of the soil that was moved to house lots was topsoil from the street areas. This material is not easily identified as transported soil material because it is similar topsoil material. Large areas of the valley were constructed in this early lot type.

This type of subdivision construction continued until about 1980, when more shaping of house lots to control drainage began. By 1980, home construction was slowing because relatively level areas that were easy for construction were already developed. After 1980, subdivision development moved into areas of alluvial fans (fig. 4) and greater slopes and lot shaping became more common. However, great disturbance of soil profiles is generally not found in this vintage of development.

After 1990, development moved into steep areas at the edge of the valley and the foothills. Soil disturbance can be severe in these areas with more than 5 feet of cuts or fills. Fills may be materials from several feet below the soil surface, have a high content of clay or fragments, and be low in organic matter and fertility. Cut areas may have subsoil materials at the surface which also may have a high content of clay or fragments and be low in organic matter and fertility.

Many of the soils of the Santa Clara Valley occur on alluvial fans or flood plains. The young, deep soils (Elder, Elpaloalto, Still, Stevenscreek, Landelspark, Botella, and Campbell) are naturally very fertile, as evidenced by their brief history of very productive agriculture. Residents will find these soils very good for gardening and growing ornamentals and lawns. Many residents have modified the soil surface texture in garden areas with sandy materials and mulches. Sandy materials can improve water penetration and the workability of the soil. Mulches improve many soil properties (including water penetration and retention), increase soil organic matter, improve workability by reducing bulk density, reduce weeds, and improve fertilizer performance.

In areas of the basin soils (Hangerone, Clear Lake, and Embarcadero), clay surface and subsurface textures and slow internal drainage due to a high clay content are formidable problems for gardens, ornamental plants, and lawns. Large amounts of organic matter added to the surface can improve workability and reduce the stickiness of soil when wet.

Figure 4.—Typical urban development on the alluvial fans in the Santa Clara Area.

How This Survey Was Made

The soil survey of the Santa Clara Area, California, Western Part, was made to provide information about the soils and miscellaneous areas in the survey area. The information available in the Web Soil Survey and this supplemental document include a description of the soils and miscellaneous areas and their location. The Web Soil Survey also provides tables and reports with maps that display the suitability, limitations, and management of the soils for specified uses.

Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The soil profile extends from the surface down into the parent material in which the soil formed. The parent material is devoid of roots and other living organisms and has not been changed by other biological activity.

In urban areas, sites in city parks and backyards were used to examine soil profiles. Open construction sites and trenches were also examined when available. In the foothills and mountains, sites in county parks and open spaces as well as road cuts were used to collect soil profile information.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area generally were collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they determined the boundaries of these bodies on aerial images, elevation data, and other data such as geology using Geographical Information Systems. They identified each natural body as a specific map unit. Aerial imagery shows trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

This survey area was mapped at two levels of detail. At the more detailed level, map units are narrowly defined. Map unit boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Boundaries were plotted and verified at wider intervals. The broadly defined units are indicated by an asterisk in the legend for the detailed soil maps. The detail of mapping was selected to meet the anticipated long-term use of the survey, and the map units were designed to meet the needs for that use.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2006). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Xerolls (*Xer*, meaning xeric or Mediterranean climate, plus *olls*, from Mollisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argixerolls (*Argi*, indicating clay accumulation in the subsoil, plus *xerolls*, the suborder of the Mollisols that has a xeric moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Pachic* identifies the subgroup that typically has a surface layer more than 50 centimeters thick and clay accumulation in the subsoil. An example is Pachic Argixerolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, smectitic, thermic Pachic Argixerolls.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. An example is the Zeppelin series, which is classified as fine, smectitic, thermic Pachic Argixerolls.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993) and in the "Field Book for Describing and Sampling Soils" (Schoeneberger and others, 2002). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1999) and in "Keys to Soil Taxonomy" (Soil Survey Staff, 2006). Following the pedon description is the range of important characteristics of the soils in the series.

Airship Series

The Airship series consists of very deep, somewhat excessively drained soils that formed in alluvium from mixed rock sources (fig. 5). Airship soils are on steep hills of remnant terraces (fig. 6). Slopes range from 30 to 65 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, thermic Typic Haploxerepts

Typical Pedon

Airship very gravelly sandy loam in an area of Minlum-Airship-Literr complex, 40 to 65 percent slopes; Santa Clara County, California; Fremont Older Open Space, Cupertino, on Coyote Ridge near the intersection of Coyote Ridge Road and a road heading east to the entrance on Prospect Road, on a steep (65 percent) southwest ridge about 100 feet below the road, under a cover of brush, in section 26, T. 7 S., R. 2 W.; at an elevation of 308 meters; UTM Zone 10, Northing 4127216, Easting 582811, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 4 inches (0 to 9 centimeters); brown (10YR 4/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 17 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; many very fine interstitial pores; 5 percent well rounded indurated 75- to 254-millimeter mixed rock fragments and 40 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 6.8 by pH meter 1:1 water; clear smooth boundary.

A2—4 to 7 inches (9 to 17 centimeters); brown (10YR 4/3), broken face, very gravelly sandy loam, dark grayish brown (10YR 4/2), broken face, moist; 15 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; many very fine interstitial pores; 5 percent rounded indurated 75- to 254-millimeter mixed rock fragments and 50 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 7.1 by pH meter 1:1 water; clear smooth boundary.

Bw1—7 to 15 inches (17 to 38 centimeters); yellowish brown (10YR 5/4), broken face, very gravelly sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 15 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; many very fine interstitial pores; 40 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 7.1 by pH meter 1:1 water; clear smooth boundary.

Figure 5.—Representative profile for the Airship series. A large volume of fragments is visible in all horizons. The rounded edges on the fragments indicate transport in water of some distance. Airship soils, although in areas where many of the ridges are sharp and narrow in shape with very steep side slopes, formed in alluvium on a very eroded older terrace. These soils are very deep but have a limited available water capacity and support mostly brush.

Figure 6.—Landscape of Airship soils at the type location, on a steep south slope near Coyote Ridge Trail in the Fremont Older Open Space. Black Mountain and the Permanente Mine are in the background.

Bw2—15 to 17 inches (38 to 44 centimeters); yellowish brown (10YR 5/4), broken face, extremely gravelly sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 13 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine interstitial pores; 60 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 7.2 by pH meter 1:1 water; abrupt smooth boundary.

C1—17 to 30 inches (44 to 75 centimeters); light yellowish brown (10YR 6/4), broken face, extremely gravelly sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 8 percent clay; massive; slightly hard, loose, nonsticky and nonplastic; many very fine interstitial pores; 70 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 7.2 by pH meter 1:1 water; clear smooth boundary.

C2—30 to 35 inches (75 to 90 centimeters); light yellowish brown (10YR 6/4), broken face, extremely gravelly sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 8 percent clay; massive; slightly hard, loose, nonsticky and nonplastic; many very fine interstitial pores; 65 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear smooth boundary.

C3—35 to 43 inches (90 to 110 centimeters); brownish yellow (10YR 6/6), broken face, extremely gravelly sandy loam, yellowish brown (10YR 5/6), broken face, moist; 8 percent clay; massive; slightly hard, loose, nonsticky and nonplastic; many very fine interstitial pores; 60 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; very slight effervescence, by HCl, 1 normal; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

C4—43 to 59 inches (110 to 150 centimeters); brownish yellow (10YR 6/6), broken face, extremely gravelly sandy loam, yellowish brown (10YR 5/6), broken face, moist; 8 percent clay; massive; slightly hard, loose, nonsticky and nonplastic; many very fine interstitial pores; 55 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 64 degrees F. The particle-size control section averages 10 to 20 percent clay and 35 to 65 percent rock fragments, mostly gravel with about 5 percent cobbles. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 0.5 to 1 percent to a depth of 9 centimeters. Rock fragments on the surface range from 5 to 10 percent gravel.

The A horizon has dry color of 10YR 5/3, 4/3, or 4/2 and moist color of 10YR 3/3 or 3/2. Texture is sandy loam or fine sandy loam and gravelly or very gravelly. Clay content ranges from 10 to 18 percent. Rock fragments range from 15 to 50 percent gravel and 0 to 5 percent cobbles. Reaction ranges from pH 6.6 to 7.8.

The Bw horizon has dry color of 10YR 5/4 or 2.5Y 5/4 and moist color of 10YR 4/4 or 2.5Y 4/4. Texture is sandy loam or sandy clay loam and very gravelly or extremely gravelly. Clay content ranges from 12 to 20 percent. Rock fragments range from 35 to 65 percent gravel and 0 to 5 percent cobbles. Reaction ranges from pH 6.6 to 7.8.

The C horizon has dry color of 10YR 6/6, 6/4, or 5/4 or 2.5Y 5/4 and moist color of 10YR 5/6, 4/4, or 4/3 or 2.5Y 4/4. Texture is sandy loam and very gravelly or extremely gravelly. Clay content ranges from 8 to 19 percent. Rock fragments range from 55 to 70 percent gravel and 0 to 5 percent cobbles. Reaction ranges from pH 6.6 to 7.8.

Alo Series

The Alo series consists of moderately deep, well drained soils that formed in residuum from sandstone (fig. 7). Alo soils are on hills (fig. 8). Slopes range from 15 to 50 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Aridic Haploxererts

Typical Pedon

Alo clay in an area of Alo-Altamont complex, 15 to 30 percent slopes; Santa Clara County, California; Ed Levin County Park, Milpitas, west of the south end of Sandy Wool Lake, uphill on a north-facing 25 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 5 S., R. 1 E.; at an elevation of 199 meters; UTM Zone 10, Northing 4145857, Easting 600431, NAD83; USGS quadrangle: Milpitas, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 2 inches (0 to 5 centimeters); very dark grayish brown (10YR 3/2), broken face, clay, very dark grayish brown (10YR 3/2), broken face, moist; 45 percent clay; moderate fine subangular blocky and strong fine granular structure; slightly hard, friable, very sticky and very plastic; many fine and many very fine roots; many fine and many very fine tubular pores; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt smooth boundary.

A2—2 to 7 inches (5 to 19 centimeters); dark grayish brown (10YR 4/2), broken face, silty clay, very dark grayish brown (10YR 3/2), broken face, moist; 45 percent clay;

Figure 7.—Representative profile of the Alo series. Photo was taken in late winter with soil cracks closed. Clay soil materials extend to a depth of 89 centimeters (to the paralithic contact of sandstone that is slightly lighter in color). Alo soils are very similar to Almont soils. Figure 9 (Altamont representative soil profile) shows the dry soil condition with soil cracks open. These are expansive soils, swelling in winter and cracking upon drying in late spring, summer, and early fall.

strong fine granular and strong fine angular blocky structure; slightly hard, friable, very sticky and very plastic; many fine and many very fine roots; many fine and many very fine tubular pores; slightly acid, pH 6.6 by pH meter 1:1 water; clear wavy boundary.

AB—7 to 14 inches (19 to 36 centimeters); dark grayish brown (10YR 4/2), broken face, silty clay, very dark grayish brown (10YR 3/2), broken face, moist; 45 percent clay; moderate medium angular blocky and moderate fine angular blocky structure; slightly hard, friable, very sticky and very plastic; many fine and many very fine

Figure 8.—Landscape of Alo and Altamont soils with its characteristic rounded hills. Alo soils are higher on the steeper slope segments, and the deeper Altamont soils are on the lower and less steep slopes. This area is in the Ed Levin County Park west of Sandy Wool Lake. Homes outside of the park can be seen in the distance.

roots; common very fine tubular pores; slightly acid, pH 6.5 by pH meter 1:1 water; clear wavy boundary.

Bss1—14 to 25 inches (36 to 64 centimeters); very dark grayish brown (10YR 3/2), broken face, silty clay, very dark grayish brown (10YR 3/2), broken face, moist; 48 percent clay; strong medium subangular blocky and strong fine angular blocky structure; slightly hard, friable, very sticky and very plastic; many very fine roots; many very fine tubular pores; 50 percent pressure faces; neutral, pH 6.7 by pH meter 1:1 water; abrupt irregular boundary.

Bss2—25 to 35 inches (64 to 89 centimeters); very dark grayish brown (10YR 3/2), broken face, clay, very dark grayish brown (10YR 3/2), broken face, moist; 48 percent clay; moderate medium angular blocky and moderate fine angular blocky structure; slightly hard, friable, very sticky and very plastic; common very fine roots; common very fine tubular pores; 20 percent pressure faces; 10 percent angular moderately cemented 2- to 75-millimeter sandstone fragments; neutral, pH 6.9 by pH meter 1:1 water; abrupt irregular boundary.

Cr1—35 to 43 inches (89 to 110 centimeters); moderately cemented, fine grained sandstone; moderately weathered and highly fractured with rock structure; weathered rock can be crushed by hand; abrupt irregular boundary.

Cr2—43 to 59 inches (110 to 150 centimeters); moderately cemented, fine grained sandstone; moderately weathered and moderately fractured with rock structure.

Range in Characteristics

Depth to paralithic sandstone is 24 to 40 inches. The mean annual soil temperature is 58 to 60 degrees F. The soil moisture control section is dry in all parts from about

May 1 to November 1 (about 180 days). The particle-size control section averages 35 to 50 percent clay and 0 to 15 percent rock fragments, mostly gravel. Mineralogy is smectitic. The soils range from noncalcareous throughout to calcareous below a depth of 20 inches. Organic matter content is 1 to 2 percent to a depth of 10 inches. Surface-initiated reversible cracks 0.5 to 1 inch wide extend to a depth of 20 inches for a period of 160 to 180 days when the soil is not irrigated. Slickensides are few or common in the Bss horizon at depths of 15 to 35 inches.

The A and AB horizons have dry color of 10YR 5/3, 4/3, 4/2, or 3/2 and moist color of 10YR 3/3 or 3/2. Texture is clay, silty clay, or clay loam. Clay content ranges from 35 to 45 percent. Rock fragments range from 0 to 10 percent gravel.

The Bss horizon has dry color of 10YR 5/4, 5/3, or 3/2 or 7.5YR 4/3 and moist color of 10YR 3/4, 3/3, or 3/2 or 7.5YR 3/3. Texture is clay, silty clay, or clay loam. Clay content ranges from 35 to 50 percent. Rock fragments range from 0 to 15 percent gravel.

Altamont Series

The Altamont series consists of deep, well drained soils that formed in residuum from sandstone and shale (fig. 9). Altamont soils are on hills (see figure 8). Slopes range from 15 to 50 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Aridic Haploxererts

Typical Pedon

Altamont clay loam in an area of Alo-Altamont complex, 15 to 30 percent slopes; Santa Clara County, California; Ed Levin County Park, City of Milpitas, west of Sandy Wool Lake, on a northeast-facing 14 percent hillslope on the south end of the valley, under a cover of annual grasses, in a nonsectionized area of T. 5 S., R. 1 E.; at an elevation of 564 feet; UTM Zone 10, Northing 4146012, Easting 600194, NAD83; USGS quadrangle: Milpitas, California. When described, the soil was moist to a depth of 10 centimeters and dry below. (Colors are for dry soil unless otherwise noted.)

A1—0 to 4 inches (0 to 10 centimeters); brown (7.5YR 4/2), broken face, clay loam, very dark brown (7.5YR 2/2), broken face, moist; 35 percent clay; strong coarse subangular blocky structure; hard, friable, very sticky and moderately plastic; many very fine roots; common very fine interstitial pores; 2 percent subangular strongly cemented 2- to 75-millimeter mixed rock fragments; moderately acid, pH 5.9 by pH meter 1:1 water; abrupt smooth boundary.

A2—4 to 10 inches (10 to 26 centimeters); brown (7.5YR 4/2), broken face, clay loam, dark brown (7.5YR 3/2), broken face, moist; 38 percent clay; moderate medium subangular blocky structure; hard, friable, very sticky and very plastic; many very fine roots; common very fine tubular pores; 40 percent discontinuous distinct clay films on all faces of peds; 2 percent subangular strongly cemented 2- to 75-millimeter mixed rock fragments; moderately acid, pH 6.1 by pH meter 1:1 water; clear wavy boundary.

Btss1—10 to 20 inches (26 to 50 centimeters); brown (7.5YR 4/2), broken face, clay, dark brown (7.5YR 3/2), broken face, moist; 40 percent clay; strong medium subangular blocky structure; hard, friable, very sticky and very plastic; few very fine roots; few very fine tubular pores; 40 percent discontinuous distinct pressure faces on all faces of peds and 60 percent discontinuous distinct clay films on all faces of peds; 5 percent subangular strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.3 by pH meter 1:1 water; clear smooth boundary.

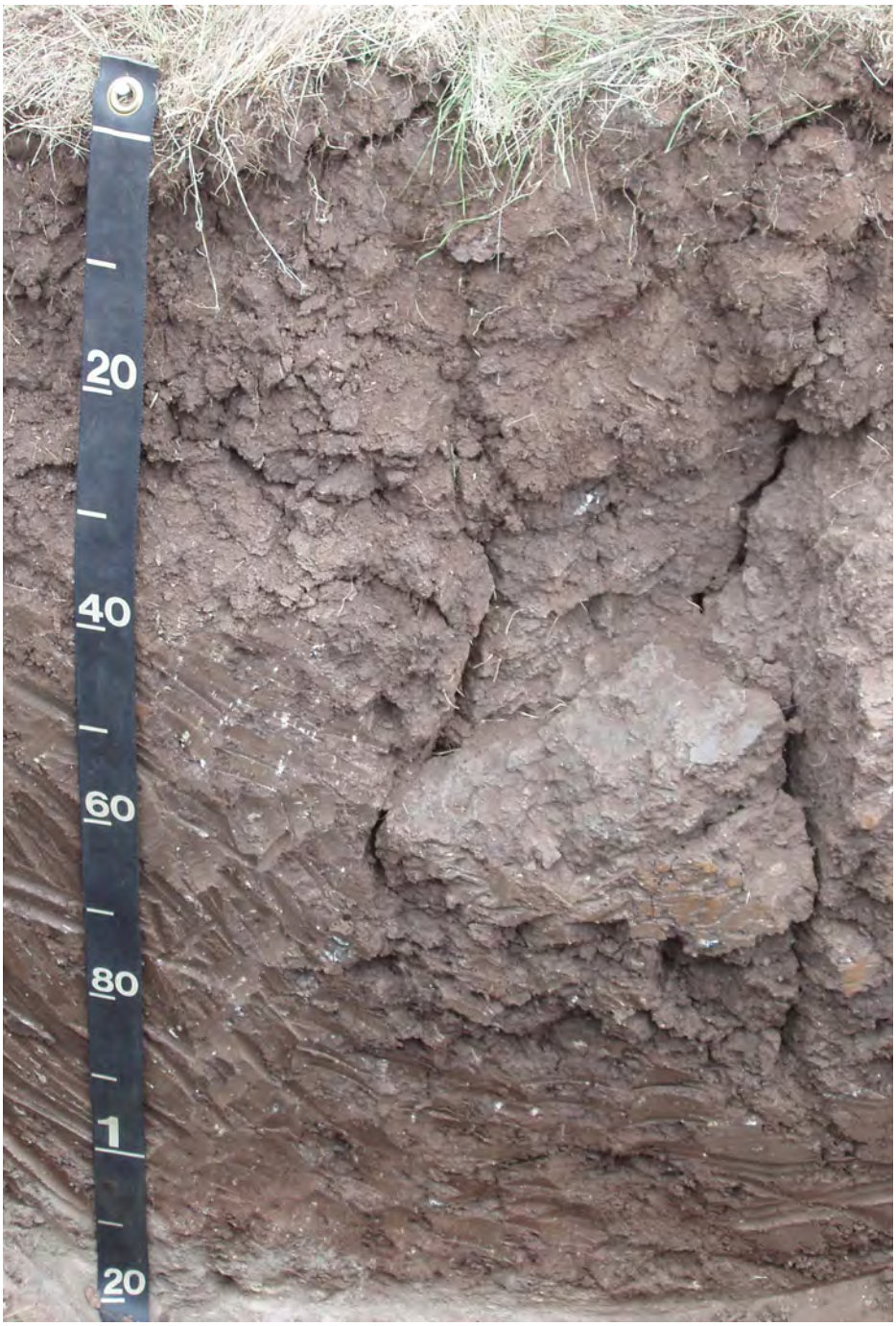


Figure 9.—Representative profile of the Altamont series. Cracking is clearly visible. The soil structure is large blocks between the cracks, which reduce soil strength. The paralithic contact of sandstone is visible at a depth of about 110 centimeters.

Btss2—20 to 35 inches (50 to 90 centimeters); brown (7.5YR 4/2), broken face, clay, dark brown (7.5YR 3/2), broken face, moist; 48 percent clay; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common very fine tubular pores; 60 percent discontinuous distinct pressure faces on all faces of peds; 1 percent carbonate masses; 5 percent subangular strongly cemented 2- to

75-millimeter mixed rock fragments; neutral, pH 6.8 by pH meter 1:1 water; clear smooth boundary.

BC—35 to 43 inches (90 to 110 centimeters); reddish brown (5YR 4/3), broken face, clay, reddish brown (5YR 4/3), broken face, moist; 45 percent clay; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common very fine tubular pores; 60 percent discontinuous distinct pressure faces on all faces of peds; 1 percent carbonate masses; 5 percent subangular strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary.

Cr—43 to 48 inches (110 to 122 centimeters); moderately cemented sandstone.

Range in Characteristics

Depth to sandstone or shale bedrock is 100 to 135 centimeters. The soil moisture control section is dry in all parts from about May 1 to November 1 (about 180 days). The particle-size control section averages 35 to 50 percent clay and 0 to 20 percent rock fragments, mostly gravel. Mineralogy is smectitic. The soils are not calcareous but may have carbonates in the lower Bsst and BC horizons above the rock contact. Organic matter content ranges from 1 to 3 percent to a depth of 10 centimeters. Surface-initiated reversible cracks 1 to 3 centimeters wide extend to a depth of 50 centimeters when the soil is dry. Slickensides occur in the Bsst horizon at depths of 26 to 90 centimeters.

The A horizon has dry color of 10YR 5/3, 4/3, or 4/2 or 7.5YR 4/2 and moist color of 10YR 3/3 or 3/2 or 7.5YR 3/2 or 2/2. Texture is clay loam or clay. Clay content ranges from 30 to 45 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from moderately acid to moderately alkaline.

The Btss horizon has dry color of 10YR 5/4 or 3/3 or 7.5YR 4/4, 4/3, or 4/2 and moist color of 10YR 4/4 or 4/3 or 7.5YR 3/4, 3/3, or 3/2. Texture is clay. Clay content ranges from 40 to 50 percent. Rock fragments range from 0 to 20 percent gravel. Reaction ranges from slightly acid to moderately alkaline.

The BC horizon (if it occurs) has dry color of 7.5YR 5/4 or 5YR 4/3 and moist color of 7.5YR 4/4 or 5YR 4/3 or 3/3. Texture is clay. Clay content ranges from 40 to 50 percent. Rock fragments range from 0 to 30 percent gravel. Reaction is slightly alkaline.

Alumrock Series

The Alumrock series consists of moderately deep, well drained soils that formed in residuum from sandstone (fig. 10). Alumrock soils are on hills (fig. 11). Slopes range from 9 to 50 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Alumrock fine sandy loam, 15 to 30 percent slopes; Santa Clara County, California; Guadalupe Grove Park, San Jose, on the north side of the main hill, up the hill from the dirt road, on a northwest-facing 35 percent slope under a cover of scattered oaks and annual grasses, in a nonsectionized area of T. 8 S., R. 1 E.; at an elevation of 387 feet; UTM Zone 10, Northing 4121762, Easting 599242, NAD83; USGS quadrangle: Los Gatos, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Figure 10.—Representative profile of the Alumrock series. The soil is moist above a depth of 40 centimeters and dry below to the paralithic contact with sandstone, at 76 centimeters. Soil colors are relatively uniform throughout the profile.

Figure 11.—Landscape of Alumrock soils in the Guadalupe Oak Grove Park in south San Jose near Guadalupe Creek. North slopes have oaks and annual grasses, and south slopes have fewer oaks. Slopes are moderately steep with rock outcrops in some areas.

Oi—0 to 1 inch (0 to 2 centimeters); dark grayish brown (10YR 4/2), exterior, slightly decomposed plant material, very dark brown (10YR 2/2), exterior, moist; abrupt smooth boundary.

A—1 to 5 inches (2 to 12 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 14 percent clay; strong fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; many very fine interstitial pores; 2 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; moderately acid, pH 6.0 by pH meter 1:1 water; clear smooth boundary.

ABt1—5 to 12 inches (12 to 30 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 19 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common fine tubular and many very fine interstitial pores; 2 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.4 by pH meter 1:1 water; abrupt smooth boundary.

ABt2—12 to 19 inches (30 to 49 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 22 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and many very fine interstitial pores; 50 percent clay films on all faces of peds; 1 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; very strongly acid, pH 4.5 by pH meter 1:1 water; clear smooth boundary.

Bt1—19 to 26 inches (49 to 66 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and common very fine roots; many fine tubular and many very fine interstitial pores; 80 percent clay films on all faces of peds; 1 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; very strongly acid, pH 4.5 by pH meter 1:1 water; abrupt smooth boundary.

Bt2—26 to 30 inches (66 to 76 centimeters); yellowish brown (10YR 5/4), broken face, sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 25 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine tubular and many very fine interstitial pores; 80 percent clay films on all faces of peds; 1 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; very strongly acid, pH 4.9 by pH meter 1:1 water; abrupt smooth boundary.

Cr—30 to 31 inches (76 to 78 centimeters); hard, unfractured, coarse grained sandstone; moderately cemented.

Range in Characteristics

Depth to moderately weathered sandstone is 50 to 100 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The particle-size control section averages 18 to 24 percent clay and 1 to 35 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 25 centimeters. Rock fragments on the surface range from 0 to 10 percent gravel.

The A horizon has dry color of 10YR 5/3 or 4/2 or 7.5YR 4/3 and moist color of 10YR 3/3 or 2/2 or 7.5YR 2.5/3. Texture is fine sandy loam, sandy loam, or loam. Clay content ranges from 14 to 16 percent. Rock fragments range from 2 to 35 percent gravel. Reaction ranges from pH 5.6 to 7.

The ABt horizon has dry color of 10YR 5/3 and moist color of 10YR 3/3. Texture is fine sandy loam, sandy clay loam, or loam. Clay content ranges from 19 to 22 percent. Rock fragments range from 1 to 35 percent gravel. Reaction ranges from pH 4.5 to 7.

The Bt horizon has dry color of 10YR 5/4 or 5/3 or 7.5YR 4/3 and moist color of 10YR 3/4 or 3/3 or 7.5YR 3/3. Texture is sandy clay loam or loam. Clay content ranges from 18 to 24 percent. Rock fragments range from 1 to 35 percent gravel. Reaction ranges from pH 4.5 to 7.

Aptos Series

The Aptos series consists of moderately deep, well drained soils that formed in residuum from mudstone (fig. 12). Aptos soils are on mountain slopes (fig. 13). Slopes range from 15 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls

Typical Pedon

Aptos loam, 15 to 30 percent slopes; Santa Clara County, California; Monte Bello Open Space Preserve, southwest of the heliport and 10 meters east of telephone lines, on a south-facing 20 percent slope, under a cover of annual grasses and coyote brush, in the northwest corner of the southwest corner of section 15, T. 7 S., R. 3 W.; at an elevation of 2,217 feet; lat. 37 degrees 19 minutes 16.6 seconds N. and long. 122 degrees 11 minutes 11.8 seconds W., NAD83; USGS quadrangle: Mindego Hill,

Figure 12.—Representative profile of the Aptos series. Small amounts of gravel occur throughout. The paralithic contact of mudstone is visible at a depth of about 70 centimeters. The subsoil from a depth of 36 to 70 centimeters is clay loam.

Figure 13.—Landscape of Aptos and Felton soils. Photo was taken from Monte Bello Open Space near Page Mill Road looking southeast along Skyline Boulevard. Felton soils typically have dense tree cover; most of the Aptos soils have been cleared and have grasses with some brush and encroaching trees. Mt. Umunhum is visible in the background.

California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 2 centimeters); slightly decomposed plant material; about 100 percent rubbed; abrupt smooth boundary.

A—1 to 4 inches (2 to 9 centimeters); brown (10YR 5/3), broken face, loam, dark brown (10YR 3/3), broken face, moist; 18 percent clay; moderate medium subangular blocky and moderate coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots throughout; few fine tubular and many very fine irregular pores; very strongly acid, pH 5.0 by pH meter 1:1 water; clear smooth boundary.

Bt1—4 to 14 inches (9 to 36 centimeters); brown (10YR 5/3), broken face, loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; moderate medium subangular blocky and moderate coarse subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few very fine roots throughout; many very fine tubular pores; 10 percent clay films on all faces of peds; 5 percent angular strongly cemented 2- to 75-millimeter mixed rock fragments; very strongly acid, pH 5.0 by pH meter 1:1 water; clear smooth boundary.

Bt2—14 to 28 inches (36 to 70 centimeters); brown (10YR 5/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 28 percent clay; moderate medium subangular blocky and moderate coarse subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few very

fine roots throughout; many very fine tubular pores; 80 percent clay films on all faces of peds; 10 percent angular strongly cemented 2- to 75-millimeter mixed rock fragments; very strongly acid, pH 4.9 by pH meter 1:1 water; abrupt wavy boundary.

Cr—28 to 34 inches (70 to 86 centimeters); moderately cemented and highly fractured mudstone.

Range in Characteristics

Depth to weathered bedrock is 50 to 100 centimeters. The soil moisture control section is dry in all parts from about July 1 to October 1 (about 90 days). The particle-size control section is 9 to 59 centimeters thick and averages 22 to 32 percent clay and 0 to 15 percent gravel. Organic matter content ranges from 4 to 0.5 percent to a depth of 70 centimeters.

The A horizon has dry color of 10YR 5/3 or 4/2 and moist color of 10YR 3/3 or 2/2. Texture is loam or silt loam. Clay content ranges from 12 to 25 percent. Rock fragments range from 0 to 10 percent gravel. Reaction ranges from pH 4.5 to 6.0.

The Bt1 horizon has dry color of 10YR 5/3 or 4/2 and moist color of 10YR 3/3 or 3/2. Texture is loam or silt loam. Clay content ranges from 22 to 32 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 4.5 to 6.0.

The Bt2 horizon has dry color of 10YR 5/3 or 2.5Y 6/4 and moist color of 10YR 3/3 or 2.5Y 4/3. Texture is clay loam. Clay content ranges from 20 to 33 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 4.5 to 6.0.

The Cr horizon is moderately weathered and highly fractured mudstone or siltstone.

Aquic Xerorthents, Bay Mud Substratum

Aquic Xerorthents, bay mud substratum consist of very deep, poorly drained soils that formed in anthropogenic fill from mixed sources over bay mud from alluvium from mixed rock sources (fig. 14). These soils are in marshes. Slopes range from 0 to 5 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy over clayey, mixed, superactive, thermic Aquic Xerorthents

Typical Pedon

Aquic Xerorthents, bay mud substratum, 0 to 2 percent slopes; Santa Clara County, California; Baylands Park, in a fill area near the entrance gate in the field east of the road, on a south-facing 1 percent slope under a cover of annual grasses and scattered pampas grass, in a nonsectionized area of T. 5 S., R. 2 W.; at an elevation of 5 feet; lat. 37 degrees 27 minutes 28 seconds N. and long. 122 degrees 6 minutes 56 seconds W., NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 9 inches (0 to 22 centimeters); brown (10YR 4/3), broken face, gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 18 percent clay; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent rounded 76- to 250-millimeter and 30 percent rounded 2- to 76-millimeter rock fragments; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary.

C1—9 to 28 inches (22 to 70 centimeters); yellowish brown (10YR 5/4), broken face, very gravelly sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 16 percent clay; weak fine subangular blocky structure; slightly hard, very friable,

Figure 14.—An area of Aquic Xerorthents, bay mud substratum. Photo was taken at the Palo Alto Baylands Nature Preserve. These soils are visible in the center of the photo filling the marsh (on the left side of the photo). Bay mud is buried with human-transported materials 60 to 150 centimeters deep. The human-transported materials above the bay mud provide good soil strength. However, the buried bay mud has poor soil strength, has accumulations of salt, sodium, and sulfur, and is saturated with water from the marsh. If the bay mud material is excavated and dried, it will become acid sulphate; the pH drops to 3.5 to 4 as the sulfur is oxidized and forms sulfuric acid.

slightly sticky and slightly plastic; 5 percent rounded 76- to 250-millimeter and 30 percent rounded 2- to 76-millimeter rock fragments; moderately alkaline, pH 8.2 by pH meter 1:1 water; abrupt smooth boundary.

C2—28 to 35 inches (70 to 89 centimeters); yellowish brown (10YR 5/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 22 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent rounded 2- to 76-millimeter rock fragments; moderately alkaline, pH 8.2 by pH meter 1:1 water; abrupt smooth boundary.

2C1—35 to 51 inches (89 to 130 centimeters); 50 percent light yellowish brown (10YR 6/4), broken face, and 50 percent grayish brown (2.5Y 5/2), broken face, silty clay, 50 percent dark yellowish brown (10YR 3/6), broken face, moist and 50 percent very dark grayish brown (2.5Y 3/2), broken face, moist; 45 percent clay; weak medium subangular blocky structure; hard, friable, very sticky and moderately plastic; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

2C2—51 to 59 inches (130 to 150 centimeters); grayish brown (2.5Y 5/2), broken face, silty clay, very dark grayish brown (2.5Y 3/2), broken face, moist; 50 percent clay; weak medium subangular blocky structure; hard, friable, very sticky and moderately plastic; neutral, pH 7.3 by pH meter 1:1 water.

Range in Characteristics

These soils are classified at the family level due to the wide range of transported materials used to fill the buried marsh soils. Colors, textures, and other soil features are those observed and may not represent the entire range of soil characteristics.

Depth to bay mud is 60 to 150 centimeters. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). A fluctuating apparent water table is at depths of 100 to 150 centimeters from December through April. The upper part of the particle-size control section averages 18 to 35 percent clay, and the lower part averages 35 to 60 percent clay. Rock fragments range from 0 to 35 percent in the upper part; the bay mud has no fragments. Mineralogy is mixed. The soils are not calcareous. The bay mud materials are highly saline and highly sodic and are potential acid sulphate soils with extremely low pH if dried completely. The load-bearing strength of bay mud is low. Redoximorphic features such as iron depletions occur in the C horizon. Rock fragments on the surface range from 0 to 5 percent gravel.

The A horizon has dry color of 10YR 5/3, 5/2, 4/3, or 3/1 or 2.5Y 5/2 and moist color of 10YR 3/3, 2/2, or 2/1 or 2.5Y 3/2. Texture is gravelly sandy loam, clay loam, or silty clay loam. Clay content ranges from 15 to 35 percent. Rock fragments range from 0 to 35 percent gravel. Reaction ranges from pH 6.6 to 8.5.

The C horizon has dry color of 10YR 6/3, 5/4, 5/3, 5/2, 5/1, or 4/3; 5Y 6/2; or 2.5Y 6/3 or 4/2. It has moist color of 10YR 4/4, 4/3, 4/2, 4/1, 3/3, or 3/2; 5Y 4/6 or 4/3; or 2.5Y 6/3 or 3/1. Texture is very gravelly sandy loam, gravelly sandy clay loam, sandy clay loam, or clay loam. Clay content ranges from 15 to 35 percent. Rock fragments range from 0 to 35 percent gravel. Reaction ranges from pH 6.6 to 8.5.

The 2C horizon has dry color of 10YR 6/4, 6/2, or 3/1; 5Y 6/2; or 2.5Y 7/1, 5/2, or 4/2. It has moist color of 10YR 3/6, 3/2, or 2/1; 5Y 3/2 or 2.5/1; or 2.5Y 6/2, 4/3, or 3/2. Texture is silty clay loam or silty clay. Clay content ranges from 35 to 60 percent. Reaction ranges from pH 6.6 to 8.5.

Argixerolls

Argixerolls consist of deep and very deep, well drained soils that formed in residuum from sandstone and shale. These soils are on foothills and mountains. Slopes range from 20 to 50 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Pachic Argixerolls

Typical Pedon

Argixerolls; Santa Clara County, California; Ed Levin County Park, City of Milpitas, west of Vista Ridge Drive on a north-facing 52 percent slope above the creek, under a cover of oaks and annual grasses and forbs, in a nonsectionized area of T. 6 S., R. 1 E.; at an elevation of 680 feet; UTM Zone 10, Northing 4144443, Easting 601996, NAD83; USGS quadrangle: Calaveras Reservoir, Milpitas, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 6 inches (0 to 15 centimeters); brown (10YR 4/3), broken face, clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 32 percent clay; strong coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

A/Bt—6 to 16 inches (15 to 40 centimeters); brown (10YR 4/3), broken face, clay, dark brown (10YR 3/3), broken face, moist; 42 percent clay; strong fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; 70 percent

distinct clay films on all faces of peds; neutral, pH 7.1 by pH meter 1:1 water; clear smooth boundary.

Bt1—16 to 26 inches (40 to 65 centimeters); brown (10YR 4/3), broken face, clay, dark brown (10YR 3/3), broken face, moist; 43 percent clay; strong fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; 50 percent distinct clay films on all faces of peds; slightly alkaline, pH 7.5 by pH meter 1:1 water; clear smooth boundary.

Bt2—26 to 37 inches (65 to 95 centimeters); brown (7.5YR 4/3), broken face, clay, dark brown (7.5YR 3/3), broken face, moist; 40 percent clay; strong fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; 50 percent distinct clay films on all faces of peds; 1 percent carbonate masses; 2 percent subangular strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

C—37 to 43 inches (95 to 110 centimeters); brown (7.5YR 4/3), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/3), broken face, moist; 28 percent clay; massive; loose, very friable, slightly sticky and slightly plastic; 1 percent carbonate masses; 20 percent subangular strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.7 by pH meter 1:1 water; abrupt smooth boundary.

Cr—43 to 49 inches (110 to 125 centimeters); weathered, fractured, fine grained sandstone; moderately cemented.

Range in Characteristics

These soils are classified at the great group level due to the variability of soil properties on the steep slopes and the limited soil development due to erosion and slope instability.

Depth to weathered sandstone is 100 to 150 centimeters. The soil moisture control section is dry in all parts from about May 15 to October 15 (about 150 days). The particle-size control section averages 35 to 45 percent clay and 0 to 5 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are calcareous in some areas in the lower Bt horizon and in the C horizons. Organic matter content ranges from 1 to 2 percent to a depth of 30 centimeters.

The A horizon has dry color of 10YR 4/3 or 4/2 and moist color of 10YR 3/2. Texture is clay loam. Clay content ranges from 30 to 35 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The Bt horizons have dry color of 10YR 4/3 or 4/2 or 7.5YR 4/3 and moist color of 10YR 3/3 or 3/2 or 7.5YR 3/2. Texture is clay. Clay content ranges from 35 to 45 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The C horizon (if it occurs) has dry color of 7.5YR 4/3 and moist color of 7.5YR 3/3. Texture is sandy clay loam. Clay content ranges from 25 to 35 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 7.3 to 7.8.

The Cr layer is highly weathered fine grained sandstone or shale and is calcareous in some areas.

Bayshore Taxadjunct

The Bayshore taxadjunct consists of very deep, poorly drained soils that formed in alluvium from mixed rock sources. Bayshore taxadjunct soils are in basins. Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Typic Argiaquolls

Typical Pedon

Bayshore taxadjunct loam in an area of Urban land-Bayshore complex, 0 to 2 percent slopes, drained; Santa Clara County, California; Sunnyvale, California, in the southwest corner near a fence, on a north-facing 1 percent slope, in a cultivated area, in a nonsectionized area of T. 6 S., R. 1 W.; at an elevation of 95 feet; UTM Zone 10, Northing 4137933, Easting 586431, NAD83; USGS quadrangle: Mountain View, California. When described, the soil was slightly moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 3 inches (0 to 7 centimeters); very dark gray (10YR 3/1), broken face, loam, black (10YR 2/1), broken face, moist; 20 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 10 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slight effervescence, by HCl, 1 normal; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

A2—3 to 12 inches (7 to 30 centimeters); dark gray (10YR 4/1), broken face, loam, black (10YR 2/1), broken face, moist; 22 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 10 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slight effervescence, by HCl, 1 normal; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

ABt—12 to 26 inches (30 to 66 centimeters); dark gray (10YR 4/1), broken face, loam, black (10YR 2/1), broken face, moist; 26 percent clay; weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; many very fine interstitial pores; 20 percent clay films on all faces of peds; 5 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slight effervescence, by HCl, 1 normal; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

ABtk—26 to 38 inches (66 to 96 centimeters); dark gray (2.5Y 4/1), broken face, sandy clay loam, black (2.5Y 2.5/1), broken face, moist; 27 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; many very fine interstitial pores; 10 percent clay films on all faces of peds; 15 percent dark yellowish brown (10YR 3/4), moist, and dark yellowish brown (10YR 4/4), dry, masses of oxidized iron; 10 percent fine carbonate masses; 1 percent rounded indurated 2- to 75-millimeter mixed rock fragments; strong effervescence, by HCl, 1 normal; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

Ck—38 to 51 inches (96 to 129 centimeters); grayish brown (2.5Y 5/2), broken face, sandy clay loam, dark grayish brown (2.5Y 4/2), broken face, moist; 24 percent clay; moderate medium subangular blocky structure; soft, very friable, slightly sticky and moderately plastic; many very fine interstitial pores; 15 percent fine carbonate masses; 1 percent rounded indurated 2- to 75-millimeter mixed rock fragments; strong effervescence, by HCl, 1 normal; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

C—51 to 61 inches (129 to 154 centimeters); light yellowish brown (2.5Y 6/3), broken face, gravelly sandy loam, olive brown (2.5Y 4/3), broken face, moist; 16 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; many very fine interstitial pores; 15 percent rounded indurated 2- to 75-millimeter mixed rock fragments; strong effervescence, by HCl, 1 normal; slightly alkaline, pH 7.6 by pH meter 1:1 water.

Range in Characteristics

Depth to the calcic horizon is 50 to 100 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts

from about May 1 to November 1 (about 180 days). The particle-size control section averages 18 to 35 percent clay and 1 to 15 percent rock fragments, mostly gravel.

Mineralogy is mixed. These soils are calcareous below a depth of 50 centimeters. Organic matter content ranges from 1 to 4 percent to a depth of 30 centimeters. The soils have been drained by historic overdrafting of ground water in the Santa Clara Valley, and flooding has been controlled by dams and channelization of streams. Redoximorphic features, such as oxidized iron masses with hue of 10YR, occur in the ABtk horizons.

The A horizons have dry color of 10YR 4/1 or 3/1 and moist color of 10YR 2/1. Texture is loam, gravelly loam, clay loam, or silty clay loam. Clay content ranges from 18 to 30 percent. Rock fragments range from 2 to 20 percent gravel. Reaction ranges from pH 7.4 to 8.4.

The ABt and ABtk horizons have dry color of 10YR 5/1, 4/2, or 4/1 or 2.5Y 4/1 and moist color of 10YR 3/1 or 2/1 or 2.5Y 2.5/1. Texture is loam, gravelly loam, sandy clay loam, or clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 1 to 15 percent gravel. Reaction ranges from pH 7.4 to 8.4.

The Ck and C horizons have dry color of 10YR 6/4, 6/3, or 5/1 or 2.5Y 7/3, 6/3, or 5/2 and moist color of 10YR 5/4, 4/4, 4/3, or 3/1 or 2.5Y 5/3, 4/3, or 4/2. Texture is sandy loam, gravelly sandy loam, loam, sandy clay loam, or clay loam. Clay content ranges from 16 to 35 percent. Rock fragments range from 1 to 15 percent gravel. Reaction ranges from pH 7.4 to 8.4.

These soils are considered a taxadjundt to the Bayshore series because they do not have a calcic horizon within 40 centimeters of the soil surface and have weak argillic horizons.

Ben Lomond Series

The Ben Lomond series consists of deep, well drained soils that formed in residuum developed from sandstone (fig. 15). Ben Lomond soils are on mountain slopes (fig. 16). Slopes range from 15 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Coarse-loamy, mixed, superactive, mesic Pachic Ultic Haploxerolls

Typical Pedon

Ben Lomond gravelly sandy loam in an area of Ben Lomond-Casrock complex, 50 to 75 percent slopes; Santa Clara County, California; from Skyline Boulevard near CDF station, along a trail east of the ridge, east of the trail down slope, on a north-facing 60 percent slope under a cover of tanoak and madrone, in the northeast corner of the southwest corner of section 6, T. 8 S., R. 3 W.; at an elevation of 2,448 feet; lat. 37 degrees 15 minutes 45.3 seconds N. and long. 122 degrees 7 minutes 53.2 seconds W., NAD83; USGS quadrangle: Mindego Hill, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 2 centimeters); slightly decomposed plant material; abrupt smooth boundary.

A1—1 to 6 inches (2 to 14 centimeters); brown (10YR 5/3), broken face, gravelly sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 10 percent clay; moderate fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common coarse roots; common medium irregular and common very fine irregular pores; strongly acid, pH 5.2 by pH meter 1:1 water; clear smooth boundary.

Figure 15.—Representative profile of the Ben Lomond series. Texture is sandy loam weathered from the sandstone rocks visible at a depth of about 1 meter. Fragments of sandstone occur throughout the profile. The soil is typically strongly acid.

Figure 16.—Landscape of Ben Lomond soils. Photo was taken in the Saratoga Gap Open Space, on Saratoga Gap Trail along Skyline Boulevard. Douglas firs dominate the forest in many areas. Vegetation also includes madrone, tanoak, bay laurel, and oaks with poison oak and ferns in the understory.

A2—6 to 13 inches (14 to 32 centimeters); brown (10YR 4/3), broken face, sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; moderate fine subangular blocky structure; moderately hard, firm, nonsticky and nonplastic; common fine and common coarse roots; common fine irregular and common medium irregular pores; very strongly acid, pH 5.0 by pH meter 1:1 water; clear smooth boundary.

Bw—13 to 28 inches (32 to 70 centimeters); dark yellowish brown (10YR 4/4), broken face, sandy loam, dark brown (10YR 3/3), broken face, moist; 17 percent clay; moderate medium subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine roots; common fine irregular and common very fine irregular pores; strongly acid, pH 5.2 by pH meter 1:1 water; gradual smooth boundary.

BC—28 to 47 inches (70 to 120 centimeters); dark yellowish brown (10YR 4/4), broken face, gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 18 percent clay; moderate fine subangular blocky structure; moderately hard, firm, slightly sticky and nonplastic; common fine and common coarse roots; common fine irregular and common medium irregular pores; strongly acid, pH 5.3 by pH meter 1:1 water; abrupt wavy boundary.

R—47 to 51 inches (120 to 130 centimeters); strongly cemented sandstone.

Range in Characteristics

Depth to bedrock is 100 to 150 centimeters. The mean annual soil temperature is 55 to 59 degrees F. The soil moisture control section is dry in all parts from about

July 1 to October 1 (about 90 days). The particle-size control section is 25 to 100 centimeters thick and averages 10 to 18 percent clay and 2 to 35 percent gravel. Mineralogy is mixed. Organic matter content ranges from 0.5 to 4 percent to a depth of 70 centimeters. Base saturation by ammonium acetate, pH 7.0 ranges from 50 to 75 percent to a depth of 120 centimeters.

The A1 horizon has dry color of 10YR 5/3 or 5/2 and moist color of 10YR 3/3, 3/2, or 2/2. Texture is gravelly sandy loam or sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 2 to 35 percent gravel. Reaction ranges from pH 5.4 to 6.8.

The A2 horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 3/3, 3/2, or 2/2. Texture is gravelly sandy loam or sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 2 to 35 percent gravel. Reaction ranges from pH 4.9 to 6.8.

The Bw horizon has dry color of 10YR 6/4, 5/3, or 4/4 and moist color of 10YR 4/4 or 3/3. Texture is gravelly sandy loam or sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 15 to 35 percent gravel. Reaction ranges from pH 4.5 to 6.1.

The BC or C horizon has dry color of 10YR 6/4, 5/4, or 4/4 and moist color of 10YR 5/3, 4/4, 3/4, or 3/3. Texture is gravelly sandy loam or sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 5 to 35 percent gravel. Reaction ranges from pH 4.8 to 6.1.

Bonnydoon Series

The Bonnydoon series consists of shallow, somewhat excessively drained soils that formed in material weathered from sandstone and shale. Bonnydoon soils are on uplands and have slopes of 5 to 85 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Loamy, mixed, superactive, thermic, shallow Entic Haploxerolls

Typical Pedon

Bonnydoon loam; Santa Cruz County, California; Scotts Valley, about 2,500 feet west-northwest along Hacienda Drive from Glenwood Drive, 700 feet north-northwest on Casa Way and 50 feet west in a pasture, 2,200 feet east and 1,000 feet south of the northwest corner of section 18, T. 10 S., R. 1 W.; lat. 37 degrees 3 minutes 55 seconds N. and long. 122 degrees 0 minutes 40 seconds W.; USGS quadrangle: Felton, California. (Colors are for dry soil unless otherwise noted.)

A1—0 to 6 inches (0 to 15 centimeters); grayish brown (10YR 5/2) loam, very dark brown (7.5YR 2/2) moist; moderate medium subangular blocky and strong medium and coarse granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; common very fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.

A2—6 to 11 inches (15 to 28 centimeters); grayish brown (10YR 5/2) loam, very dark brown (7.5YR 2/2) moist; moderate medium angular blocky and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; common coarse and many fine, very fine, and medium tubular pores and many very fine interstitial pores; moderately acid (pH 6.0); abrupt wavy boundary.

Cr—11 to 40 inches (28 to 102 centimeters); white (2.5Y 8/2) fine grained weathered and fractured sandstone, light yellowish brown (2.5Y 6/4) moist; massive; slightly acid (pH 6.2).

Range in Characteristics

Depth to a paralithic contact is 7 to 20 inches. The soil between depths of 6 to 18 inches or to the paralithic contact typically becomes moist in some part in November or early December and remains moist until May. The mean annual soil temperature is about 59 to 61 degrees F. The difference between mean summer and winter soil temperatures is 15 to 25 degrees F. Organic matter is more than 1 percent throughout the solum. The profile is heavy sandy loam, heavy fine sandy loam, loam, gravelly loam, sandy clay loam, or clay loam and has 18 to 30 percent clay. Gravel ranges from 0 to 10 percent, by volume. Reaction ranges from moderately acid to neutral. Base saturation is more than 75 percent throughout the profile.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3.

Some pedons have a C horizon with color of 10YR 6/3 or 7.5YR 5/4 or 6/4.

Botella Series

The Botella series consists of very deep, well drained soils that formed in material developed from alluvium (fig. 17). Botella soils are on alluvial fan remnants. Slopes range from 0 to 2 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Botella sandy clay loam in an area of Urban land-Botella complex, 0 to 2 percent slopes; Santa Clara County, California; Sunnyvale Historical Orchard, Sunnyvale, between rows 5 and 6 running north-south and between rows 11 and 12 running east-west, on a north-facing 2 percent slope under a cover of apricot trees, in section 1, T. 7 S., R. 2 W.; at an elevation of 121 feet; UTM Zone 10, Northing 4134788, Easting 586362, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 7 inches (0 to 17 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 20 percent clay; moderate medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few medium roots; common very fine interstitial pores; 2 percent subrounded indurated 2- to 75-millimeter rock fragments; moderately acid, pH 6.0 by pH meter 1:1 water; abrupt wavy boundary.

A—7 to 14 inches (17 to 35 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; moderate coarse subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few fine and few coarse roots; common very fine interstitial pores; 2 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt wavy boundary.

Bt1—14 to 21 inches (35 to 54 centimeters); brown (10YR 4/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 32 percent clay; moderate medium subangular blocky structure; hard, very friable, moderately sticky and moderately plastic; few fine roots; common very fine interstitial pores; 50 percent clay films on all faces of peds; 2 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

Bt2—21 to 34 inches (54 to 87 centimeters); dark yellowish brown (10YR 4/4), broken face, clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 36 percent

Figure 17.—Representative profile of the Botella series. Photo was taken at the Sunnyvale Historical Orchard, where Botella soils are still cultivated for orchards. The sandy clay loam texture allows good rooting and nutrient uptake for many plants. The soils provide an excellent medium for growing trees, lawns, gardens, and ornamental plants. Most areas of these soils have been urbanized.

clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; few fine roots; common very fine tubular pores; 75 percent clay films on all faces of peds; 2 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

Bt3—34 to 55 inches (87 to 140 centimeters); dark yellowish brown (10YR 4/4), broken face, clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 35 percent clay; moderate coarse subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common very fine interstitial pores; 50 percent clay films on all faces of peds; 5 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt smooth boundary.

Bt4—55 to 68 inches (140 to 173 centimeters); yellowish brown (10YR 5/4), broken face, clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 35 percent clay; moderate coarse subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common very fine interstitial pores; 2 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section is 54 to 104 centimeters thick. It averages 27 to 35 percent clay and 5 to 15 percent rock fragments, mostly gravel. Mineralogy is mixed. Organic matter content ranges from 1 to 3 percent to a depth of 35 centimeters and from 0.75 to 1.5 percent to a depth of 54 centimeters. Rock fragments on the surface range from 0 to 5 percent gravel.

The Ap horizon has dry color of 10YR 5/3, 5/2, 4/3, 4/2, or 3/2 and moist color of 10YR 3/3, 3/2, or 2/2. Texture is fine sandy loam, sandy loam, loam, or sandy clay loam or gravelly sandy loam, sandy loam, loam, or sandy clay loam. Clay content ranges from 15 to 27 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 5.6 to 7.8.

The A horizon has dry color of 10YR 5/3, 5/2, 4/3, or 4/2 and moist color of 10YR 4/3, 3/3, 3/2, or 2/2. Texture is sandy loam, loam, or sandy clay loam or gravelly sandy loam, loam, or sandy clay loam. Clay content ranges from 15 to 35 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The Bt1, Bt2, and Bt3 horizons have dry color of 10YR 6/3, 5/4, 5/3, 5/2, 4/4, 4/3, or 4/2 and moist color of 10YR 4/6, 4/4, 4/3, 3/4, 3/3, or 3/2. Texture is sandy clay loam or clay loam or gravelly sandy clay loam or clay loam. Clay content ranges from 27 to 38 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The Bt4 horizon has dry color of 10YR 5/6, 5/4, or 4/6 and moist color of 10YR 4/6, 4/4, or 3/4. Texture is sandy clay loam or clay loam or gravelly sandy clay loam or clay loam. Clay content ranges from 27 to 35 percent. Rock fragments range from 5 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.3.

Campbell Series

The Campbell series consists of very deep, moderately well drained soils that formed in alluvium from mixed rock sources (fig. 18). Campbell soils are on alluvial fans and flood plains (fig. 19). Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-silty, mixed, superactive, thermic Cumulic Haploxerolls

Typical Pedon

Campbell silt loam, 0 to 2 percent slopes, protected; Santa Clara County, California; northwest of the corner of Zanker Road and River Oaks Parkway, San Jose, 25 orange tree rows west of the northeast corner of the orange orchard, between 3 and 4 tree rows south, on the north side of the orchard, on a south-facing 1 percent slope, in a nonsectionized area of T. 6 S., R. 1 W.; at an elevation of 6 meters; UTM Zone 10, Northing 4140452, Easting 0594130, NAD83; USGS quadrangle: Milpitas, California. When described, the soil was dry to a depth of 25 centimeters and moist below. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 10 inches (0 to 25 centimeters); brown (10YR 5/3), broken face, silt loam, very dark grayish brown (10YR 3/2), broken face, moist; 24 percent clay; moderate medium subangular blocky and moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; neutral, pH 7.1 by pH meter 1:1 water; abrupt smooth boundary.

Figure 18.—Representative profile of the Campbell series. The surface layer is very loose because of cultivation. The subsoil is silty clay loam that contains more clay as depth increases. Smooth excavation surfaces are visible below a depth of 80 centimeters. A buried clay soil occurs below 1 meter.

A1—10 to 24 inches (25 to 60 centimeters); brown (10YR 5/3), broken face, silt loam, very dark grayish brown (10YR 3/2), broken face, moist; 26 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few medium roots; common very fine interstitial and many very fine tubular pores; slightly alkaline, pH 7.5 by pH meter 1:1 water; gradual smooth boundary.

A2—24 to 31 inches (60 to 80 centimeters); grayish brown (10YR 5/2), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 28 percent clay; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few medium roots; common very fine interstitial pores; slightly alkaline, pH 7.7 by pH meter 1:1 water; gradual smooth boundary.

Figure 19.—A cultivated hayfield and an orange orchard in an area of Campbell soils along Zanker Road in San Jose, on the lower Guadalupe River-Coyote Creek flood plain. Newly constructed residential housing is in the background. Repeated annual flooding produced these silty soils, which are today protected by levees and upstream dams and drained by lowering the water table of the region. Most areas have been urbanized. Campbell soils are excellent for growing plants of all types.

A3—31 to 38 inches (80 to 97 centimeters); grayish brown (10YR 5/2), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 29 percent clay; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few medium roots; common very fine interstitial pores; slightly alkaline, pH 7.7 by pH meter 1:1 water; gradual smooth boundary.

2A—38 to 51 inches (97 to 130 centimeters); dark grayish brown (10YR 4/2), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 29 percent clay; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common very fine interstitial pores; 10 percent faint clay films on all faces of peds; strong effervescence, by HCl, 1 normal; slightly alkaline, pH 7.7 by pH meter 1:1 water; clear smooth boundary.

2Bw1—51 to 71 inches (130 to 180 centimeters); 50 percent dark grayish brown (10YR 4/2), broken face, and 50 percent gray (10YR 5/1), broken face, silty clay, 50 percent very dark grayish brown (10YR 3/2), broken face, moist and 50 percent dark gray (10YR 4/1), broken face, moist; 40 percent clay; massive; hard, friable, very sticky and moderately plastic; common very fine interstitial pores; violent effervescence, by HCl, 1 normal; slightly alkaline, pH 7.7 by pH meter 1:1 water; gradual smooth boundary.

2Bw2—71 to 79 inches (180 to 200 centimeters); 30 percent grayish brown (10YR 5/2), broken face, and 70 percent gray (10YR 5/1), broken face, silty clay, 30

percent dark grayish brown (10YR 4/2), broken face, moist and 70 percent dark gray (10YR 4/1), broken face, moist; 45 percent clay; massive; hard, friable, very sticky and moderately plastic; common very fine interstitial pores; 5 percent carbonate coats; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 7.9 by pH meter 1:1 water.

Range in Characteristics

The soils developed in alluvium of mixed mineralogy. Mean soil temperature is between 60 and 64 degrees F. The soil moisture control section is dry in all parts from about June 15 to October 15 (about 120 days). The particle-size control section averages 27 to 35 percent clay and has less than 15 percent sand coarser than medium.

The Ap horizon has dry color of 10YR 5/3, 4/2, or 3/1 or 2.5Y 5/3 and moist color of 10YR 3/2, 2/2, or 2/1 or 2.5Y 3/3. Texture is silt loam or silty clay loam. Clay content is 20 to 35 percent. Reaction ranges from pH 6.6 to 8.4.

The A horizons have dry color of 10YR 5/3, 5/2, or 4/2 or 2.5Y 5/3 and moist color of 10YR 4/3, 4/2, 3/2, 3/1, or 2/2 or 2.5Y 3/3. Texture is silt loam or silty clay loam. Clay content is 25 to 35 percent. Reaction ranges from pH 6.6 to 8.4. The lower part of the A horizon may contain masses of oxidized iron with chroma of 4 or 6.

The 2A horizon has dry color of 10YR 4/2 or 3/1 or 2.5Y 5/2 and moist color of 10YR 3/2 or 2/2 or 2.5Y 3/2. Oxidized iron masses may also occur with moist color of 10YR 5/8 or 5/6. Texture is silty clay loam. Clay content is 27 to 35 percent. Reaction ranges from pH 6.6 to 8.4.

The 2Bw horizons have dry color of 10YR 5/2 or 4/2 or 2.5Y 5/3, 4/1, 3/2, or 3/1 and moist color of 10YR 4/2, 3/2, or 2/1; 2.5Y 3/3, 3/1, or 2/2; or 5Y 2.5/2. Iron depletions have moist color of 10YR 4/1. Iron masses have moist color of 10YR 6/4, 5/8, 5/6, 5/4, or 4/4. Texture is silty clay loam or silty clay. Clay content is 35 to 50 percent. Reaction ranges from pH 6.6 to 8.4.

Caninecreek Series

The Caninecreek series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 20). Caninecreek soils are on flood plains and alluvial fans (fig. 21). Slopes range from 1 to 5 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls

Typical Pedon

Caninecreek fine sandy loam in an area of Caninecreek-Elder complex, 0 to 2 percent slopes, rarely flooded; Santa Clara County, California; Hellyer County Park on Hellyer Avenue, San Jose, south of Hellyer Avenue on the northwest end of the lawn, west of wastewater mounds, on a southwest-facing 2 percent slope under a cover of lawn grass, in a nonsectionized area of T. 7 S., R. 2 E.; at an elevation of 154 feet (47 meters); UTM Zone 10, Northing 4127003, Easting 605267, NAD83; USGS quadrangle: San Jose East, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 7 inches (0 to 18 centimeters); dark grayish brown (10YR 4/2), broken face, fine sandy loam, very dark brown (10YR 2/2), broken face, moist; 12 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; 5 percent rounded indurated 2- to 75-millimeter mixed rock fragments; moderately alkaline, pH 7.9 by pH meter 1:1 water; clear smooth boundary.

Figure 20.—Representative profile of the Caninecreek series. Textures are coarse-loamy, and sandy loam is the dominant texture. Scattered gravel occur to a depth of 118 centimeters; below that depth the soil is very gravelly. A traffic pan is visible at a depth of 47 to 70 centimeters. Caninecreek soils have been farmed in some areas and have surface modification in parks.

A2—7 to 14 inches (18 to 36 centimeters); grayish brown (10YR 5/2), broken face, fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 10 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial pores; 10 percent rounded indurated 2- to 75-millimeter mixed rock fragments; moderately alkaline, pH 7.9 by pH meter 1:1 water; abrupt smooth boundary.

Figure 21.—Landscape of Caninecreek soils in Hellyer County Park, in San Jose, along Coyote Creek. Caninecreek soils were produced by flooding, which is modified today by upstream dams and some levees. Oaks occur in most areas. Coyote Creek channel is in the dense vegetation in the background.

A3—14 to 19 inches (36 to 47 centimeters); grayish brown (10YR 5/2), broken face, fine sandy loam, dark grayish brown (10YR 4/2), broken face, moist; 8 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

2Ab—19 to 28 inches (47 to 70 centimeters); gray (10YR 5/1), broken face, fine sandy loam, dark gray (10YR 4/1), broken face, moist; 18 percent clay; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine interstitial pores; 5 percent faint silt coats on all faces of peds; 50 percent medium brown (10YR 5/3), dry, and brown (10YR 4/3), moist, masses of oxidized iron in matrix; 1 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water; clear smooth boundary.

2Cb1—28 to 36 inches (70 to 91 centimeters); yellowish brown (10YR 5/4), broken face, fine sandy loam, brown (10YR 4/3), broken face, moist; 16 percent clay; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine interstitial pores; 5 percent faint silt coats on all faces of peds; 20 percent medium gray (10YR 5/1), dry, and dark gray (10YR 4/1), moist, iron depletions in matrix; 1 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.7 by pH meter 1:1 water; clear smooth boundary.

2Cb2—36 to 46 inches (91 to 118 centimeters); light brownish gray (10YR 6/2), broken face, fine sandy loam, dark grayish brown (10YR 4/2), broken face, moist; 15

percent clay; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine interstitial pores; 5 percent faint silt coats on all faces of peds; 30 percent medium yellowish brown (10YR 5/6), dry, and yellowish brown (10YR 5/4), moist, masses of oxidized iron in matrix; 1 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary.

3C—46 to 59 inches (118 to 150 centimeters); dark grayish brown (10YR 4/2), broken face, extremely gravelly sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 13 percent clay; massive; loose, loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent subrounded indurated 75- to 254-millimeter mixed rock fragments and 70 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water.

Range in Characteristics

Depth to the extremely gravelly substratum (3C horizon) ranges from 52 to 125 centimeters. The mean annual soil temperature is 58 to 62 degrees F. The particle-size control section averages 10 to 16 percent clay and 5 to 35 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 35 centimeters. The hazard of flooding is reduced by upstream dams and some low levees; most areas are flooded occasionally during high stream flows.

The A horizon has dry color of 10YR 5/3, 5/2, or 4/2 or 2.5Y 5/3 or 5/2 and moist color of 10YR 4/2, 3/3, 3/2, or 2/2 or 2.5Y 3/3 or 3/2. Texture is fine sandy loam, sandy loam, loam, or sandy clay loam. Clay content ranges from 10 to 26 percent. Rock fragments range from 5 to 25 percent gravel. Reaction ranges from pH 7.1 to 8.3.

The 2Ab horizon has dry color of 10YR 5/3 or 5/1 and moist color of 10YR 4/3 or 4/1. Texture is sandy loam or fine sandy loam. Clay content ranges from 16 to 18 percent. Rock fragments range from 1 to 15 percent gravel. Reaction ranges from pH 7.6 to 8.0.

The 2Cb horizon has dry color of 10YR 6/2, 5/4, 5/3, or 4/2 and moist color of 10YR 4/3, 4/2, or 3/2. Texture is sandy loam or fine sandy loam. Clay content ranges from 8 to 16 percent. Rock fragments range from 1 to 15 percent gravel. Reaction ranges from pH 7.7 to 7.8.

The 3C horizon has dry color of 10YR 5/2 or 4/2 or 2.5Y 5/3 and moist color of 10YR 3/2 or 2.5Y 3/3. Texture is very gravelly loamy coarse sand, very gravelly loamy sand, very gravelly sand, or very gravelly sandy loam. Clay content ranges from 5 to 14 percent. Rock fragments range from 40 to 70 percent gravel and from 0 to 5 percent cobbles. Reaction ranges from pH 7.6 to 8.2.

Casrock Series

The Casrock series consists of moderately deep, well drained soils that formed in residuum from sandstone (fig. 22). Casrock soils are on mountains (fig. 23). Slopes range from 8 to 30 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Pachic Ultic Haploxerolls

Typical Pedon

Casrock sandy loam in an area of Casrock-Skyridge-Rock outcrop complex, 8 to 30 percent slopes; Santa Clara County, California; Skyline County Park, along Skyline Boulevard, east of the road at a trailhead and road gate, south on the ridge about 500

Figure 22.—Representative profile of the Casrock series. This moderately deep soil has sandstone bedrock visible at a depth of 76 centimeters. Many gravel and cobbles are visible. Soil pH below the A horizon ranges from strongly acid to extremely acid.

feet, on a southwest-facing 20 percent slope under a cover of Douglas fir, California bay laurel, oak, and poison oak, in section 22, T. 8 S., R. 3 W.; at an elevation of 879 meters; UTM Zone 10, Northing 4119635, Easting 582200, NAD83; USGS quadrangle: Castle Rock Ridge, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.) About 30 to 50 percent of the surface is covered with decaying needles, leaves, and twigs.

Oi—0 to 2 inches (0 to 4 centimeters); very dark brown (10YR 2/2), rubbed, slightly decomposed plant material, very dark brown (10YR 2/2), rubbed, moist; abrupt smooth boundary.

A1—2 to 4 inches (4 to 10 centimeters); grayish brown (10YR 5/2), broken face, sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 12 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common fine roots; many very fine interstitial pores; 10 percent

Figure 23.—Landscape of Casrock soils. Photo was taken in the Saratoga Gap Open Space along Saratoga Gap Trail along Skyline Boulevard.

subangular strongly cemented 2- to 75-millimeter sandstone fragments; pH 5.9 by pH meter 1:1 water; clear smooth boundary.

A2—4 to 13 inches (10 to 33 centimeters); grayish brown (10YR 5/2), broken face, gravelly sandy clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 12 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common fine and common medium roots; many very fine interstitial pores; 10 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments and 15 percent subangular strongly cemented 75- to 210-millimeter sandstone fragments; pH 4.7 by pH meter 1:1 water; clear smooth boundary.

AC—13 to 30 inches (33 to 76 centimeters); brown (10YR 5/3), broken face, cobbly fine sandy loam, dark brown (10YR 3/3), broken face, moist; 10 percent clay; massive; soft, very friable, nonsticky and nonplastic; common fine, common medium, and common coarse roots; many very fine interstitial pores; 20 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments and 30 percent subangular strongly cemented 75- to 210-millimeter sandstone fragments; pH 5.0 by pH meter 1:1 water; abrupt wavy boundary.

R—30 to 32 inches (76 to 82 centimeters); unfractured, coarse grained sandstone; strongly cemented.

Range in Characteristics

Depth to sandstone bedrock is 70 to 85 centimeters. The mean annual soil temperature is 55 to 59 degrees F. The particle-size control section averages 10 to 18 percent clay and 35 to 55 percent rock fragments (35 to 45 percent gravel and 0 to 30 percent cobbles). Mineralogy is mixed. The soils are not calcareous. Organic matter

content ranges from 2 to 5 percent to a depth of 20 centimeters. Base saturation by sum of cations ranges from 35 to 75 percent to a depth of 76 centimeters. Rock fragments on the surface range from 0 to 20 percent boulders.

The A horizon has dry color of 10YR 5/3, 5/2, or 4/3 and moist color of 10YR 3/2 or 2/2. Texture is fine sandy loam, gravelly fine sandy loam, or cobbly fine sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 10 to 40 percent gravel and 0 to 15 percent cobbles. Reaction ranges from pH 4.7 to 6.0.

The AC horizon has dry color of 10YR 6/4, 6/3, 5/3, or 5/2 and moist color of 10YR 4/4, 3/3, or 3/2. Texture is very gravelly fine sandy loam, very gravelly sandy clay loam, or cobbly fine sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 20 to 45 percent gravel and 15 to 30 percent cobbles. Reaction ranges from pH 4.1 to 5.6.

Catelli Series

The Catelli series consists of moderately deep, well drained soils that formed in material weathered from sandstone or granitic rocks. Catelli soils are on uplands and have slopes of 30 to 75 percent. The mean annual precipitation is about 48 inches, and the mean annual air temperature is about 55 degrees F.

Taxonomic Classification

Coarse-loamy, mixed, superactive, mesic Ultic Haploxerolls

Typical Pedon

Catelli sandy loam; Santa Cruz County, California; about 2,100 feet (0.4 mile) along Bloom Grade Road from Hilton Drive, opposite junction with a side road, and 15 feet back from a road cut, in a forested area, in the northwest corner of section 14, T. 9 S., R. 3 W.; lat. 37 degrees 9 minutes 32 seconds N. and long. 122 degrees 10 minutes 14 seconds W., NAD83; USGS quadrangle: Big Basin, California. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 3 inches (0 to 8 centimeters); litter of leaves, bark, and twigs in various stages of decomposition; moderately acid (pH 6.0); abrupt wavy boundary. (1 to 6 inches thick)

A—3 to 7 inches (8 to 18 centimeters); brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak and moderate fine and medium granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine and fine tubular and interstitial pores; slightly acid (pH 6.4); clear wavy boundary. (7 to 10 inches thick)

B1—7 to 13 inches (18 to 33 centimeters); yellowish brown (10YR 5/4) sandy loam, dark brown (10YR 3/3) moist; moderate coarse and very coarse granular and medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; few thin clay films as bridges between mineral grains and on faces of some peds; slightly acid (pH 6.2); clear wavy boundary. (6 to 10 inches thick)

B2—13 to 23 inches (33 to 58 centimeters); light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 3/3) moist; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and few medium roots; many very fine and fine tubular pores; very few thin clay films as bridges between mineral grains and on faces of some peds; moderately acid (pH 6.0); clear wavy boundary. (7 to 10 inches thick)

C—23 to 37 inches (58 to 94 centimeters); very pale brown (10YR 7/4) sandy loam, brown (7.5YR 4/4) moist; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, and medium roots;

common very fine and fine tubular pores; few pebbles; strongly acid (pH 5.5); gradual wavy boundary. (0 to 24 inches thick)

Cr—37 to 42 inches (94 to 107 centimeters); very pale brown (10YR 7/4) strongly weathered sandstone, yellowish brown (10YR 5/4) moist; massive and hard in places but crushing to sandy loam under hand pressure; roots in fractures that are more than 10 centimeters apart; strongly acid (pH 5.4).

Range in Characteristics

Depth to a paralithic contact is 20 to 40 inches. The soil between depths of 10 and 29 inches becomes moist in some part in late November or December and remains moist until about May. Organic matter content is more than 1 percent at a depth of 10 inches and less than 1 percent at a depth of 20 inches. Base saturation is more than 50 percent in all parts and less than 75 percent in some or all parts of the soil to a depth of 30 inches. Gravel in the solum ranges from 0 to 15 percent, by volume.

The A horizon is dark grayish brown, dark brown, grayish brown, or brown (10YR 4/2, 4/3, 5/2, or 5/3). Texture is sandy loam, fine sandy loam, or very fine sandy loam. This horizon is moderately acid to neutral.

The B horizons are yellowish brown, light yellowish brown, or brown (10YR 5/4 or 6/4 or 7.5YR 5/2 or 5/4). Texture is sandy loam, fine sandy loam, or very fine sandy loam. This horizon is moderately acid or slightly acid.

The C horizon is light yellowish brown, very pale brown, or pinkish gray (2.5Y 6/4; 10YR 6/4, 7/4, or 8/3; or 7.5YR 6/2). Texture is gravelly sandy loam or sandy loam. This horizon is strongly acid to slightly acid.

Clear Lake Series

The Clear Lake series consists of very deep, poorly drained soils that formed in alluvium from mixed rock sources (fig. 24). Clear Lake soils are in basins. Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Xeric Endoaquerts

Typical Pedon

Clear Lake silty clay, 0 to 2 percent slopes, drained; Santa Clara County, California; Lester Park Property, San Jose, in the southwest corner, west of the pump house and north of the creek, on a west-facing 0 percent slope under a cover of wheat stubble in a nonsectionized area of T. 8 S., R. 1 E.; at an elevation of 51 meters; UTM Zone 10, Northing 4124095, Easting 0602537, NAD83; USGS quadrangle: San Jose East, California. When described, the soil was dry to a depth of 36 centimeters and slightly moist below. (Colors are for dry soil unless otherwise noted.)

Ap1—0 to 9 inches (0 to 23 centimeters); dark gray (10YR 4/1), broken face, silty clay, black (10YR 2/1), broken face, moist; 45 percent clay; strong fine subangular blocky and strong medium subangular blocky structure; hard, friable, very sticky and very plastic; many fine, common medium, and many very fine roots; many fine, common medium, and many very fine tubular pores; slightly alkaline, pH 7.8 by pH meter 1:1 water; clear smooth boundary.

Ap2—9 to 14 inches (23 to 36 centimeters); dark gray (10YR 4/1), broken face, silty clay, black (10YR 2/1), broken face, moist; 45 percent clay; strong fine subangular blocky and strong medium subangular blocky structure; hard, friable, very sticky and very plastic; common fine, common medium, and common very fine roots;

Figure 24.—Representative profile of the Clear Lake series. It is located in a cultivated area of County Park property in south San Jose. The soil is dark gray clay to a depth of more than 120 centimeters, which is typical for Clear Lake soils. When dry, large cracks will extend to a depth of 1 meter. These cracks swell shut with the winter rains or stay closed with irrigation. The swelling and cracking can damage structures if they are not insulated from the soils. Below a depth of 120 centimeters, the amount of carbonates (visible white areas) increases. Clear Lake soils occur in basins that were flooded yearly but are now drained in the survey area and nearly all urbanized. Gardeners will find these soils difficult to work without amending them with large amounts of organic matter.

many fine, common medium, and many very fine tubular pores; slightly alkaline, pH 7.8 by pH meter 1:1 water; clear wavy boundary.

Bw—14 to 32 inches (36 to 82 centimeters); dark gray (10YR 4/1), broken face, silty clay, black (10YR 2/1), broken face, moist; 47 percent clay; moderate fine subangular blocky and moderate medium subangular blocky structure; hard, friable, very sticky and very plastic; common medium roots; common fine and common medium tubular pores; slightly alkaline, pH 7.8 by pH meter 1:1 water; clear wavy boundary.

Bssg—32 to 50 inches (82 to 127 centimeters); dark gray (10YR 4/1), broken face, silty clay, black (10YR 2/1), broken face, moist; 48 percent clay; strong very coarse angular blocky structure; hard, friable, very sticky and very plastic; common medium roots; 40 percent pressure faces on slickensides; 2 percent fine dark yellowish brown (10YR 3/4), moist, and dark yellowish brown (10YR 4/4), dry, masses of oxidized iron on faces of peds; slightly alkaline, pH 7.8 by pH meter 1:1 water; clear wavy boundary.

Bkg—50 to 66 inches (127 to 167 centimeters); light brownish gray (2.5Y 6/2), broken face, silty clay, grayish brown (2.5Y 5/2), broken face, moist; 40 percent clay; massive; hard, friable, very sticky and moderately plastic; common fine roots; 30 percent fine light olive brown (2.5Y 5/4), moist, and light yellowish brown (2.5Y 6/4), dry, masses of oxidized iron on faces of peds; carbonates in soft masses are effervescent; slightly alkaline, pH 7.8 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. These soils have been drained by historic overdrafting of ground water in the Santa Clara Valley, and flooding has been controlled by dams and the channelization of streams. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section averages 35 to 50 percent clay. Mineralogy is smectitic. The soils are commonly calcareous in the Bw, Bss, and Bk horizons. Organic matter content ranges from 1 to 4 percent to a depth of 36 centimeters. Surface-initiated reversible cracks 1 to 5 centimeters wide extend to a depth of 30 centimeters from June 1 to October 15 when the soil is not irrigated or cultivated. Slickensides occur in the Bss horizon. A fluctuating apparent water table may occur at depths of 125 to 150 centimeters from January through March. Redoximorphic features such as masses of iron occur in the Bssg and Bkg horizons.

The Ap horizons have dry color of 10YR 4/1 or 3/1 or 2.5Y 4/1 and moist color of 10YR 2/1 or 2.5Y 2.5/1. Texture is silty clay loam, clay loam, silty clay, or clay. Clay content ranges from 35 to 50 percent. Reaction ranges from pH 6.6 to 7.8.

The Bw and Bssg horizons have dry color of 10YR 4/1 or 3/1 or 5Y 6/1 or 5/1 and moist color of 10YR 3/1 or 2/1; 5Y 4/1; or 2.5Y 4/1. Texture is silty clay loam, clay loam, silty clay, or clay. Clay content ranges from 35 to 50 percent. Reaction ranges from pH 6.6 to 7.8.

The Bkg horizon has dry color of 2.5Y 6/3, 6/2, or 5/3 and moist color of 2.5Y 5/2, 4/3, or 3/2. Texture is silty clay loam, clay loam, sandy clay loam, silty clay, or clay. Clay content ranges from 30 to 45 percent. Carbonates occur in soft masses and are effervescent. Reaction ranges from pH 7.3 to 7.8.

Climara Series

The Climara series consists of well drained, slowly permeable soils on mountains and uplands. Climara soils formed in mass movement deposits derived from Franciscan melange serpentine, serpentinite, graywacke, chert, gabbro, and blue schist and other ultrabasic rocks. Slopes range from 9 to 50 percent. The mean annual

precipitation is 10 to 25 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, magnesic, thermic Aridic Haploxererts

Typical pedon

Climara clay; San Benito County, California; approximately 1,000 feet east of the San Andreas Fault, 10 yards south of the ranch road and 0.75 mile east of State Highway 25, in annual grass pasture, about 1,400 feet north and 550 feet east of the southeast corner of sec. 24, T. 18 S., R. 9 E., MDB&M; lat. 36 degrees 20 minutes 47 seconds N. and long. 120 degrees 56 minutes 23 seconds W., NAD 27; USGS quadrangle: Lonoak, California. (Colors are for dry soil unless otherwise noted.)

A—0 to 12 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; strong very fine granular structure; very hard, very firm, very sticky and very plastic; many very fine and fine roots; few very fine and few fine tubular pores; neutral; gradual smooth boundary. (8 to 13 inches thick)

Bss—12 to 28 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; strong fine angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; many small, medium, and coarse intersecting slickensides; slightly effervescent, carbonates disseminated; slightly alkaline; gradual smooth boundary. (13 to 20 inches thick)

Bk—28 to 36 inches; light yellowish brown (2.5Y 6/4) gravelly clay, olive brown (2.5Y 4/4) moist; moderate fine subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine and fine tubular pores; strongly effervescent, carbonates segregated as common small seams and soft masses; moderately alkaline; gradual irregular boundary. (7 to 12 inches thick)

R—36 to 60 inches; fractured, fine grained greenish gray serpentine.

Range in Characteristics

Depth to a lithic contact is 20 to 40 inches. The mean soil temperature is about 59 to 65 degrees F. These soils have cracks more than 1 millimeter wide to a depth of 20 inches or more. The cracks are open from about May until December and remain closed the rest of the year. Gravel, cobbles, and stones occur in some pedons, particularly in or near the surface, but constitute less than 35 percent of the volume.

The A horizon has dry color of 10YR 2/1, 3/1, 4/1, 5/1, or 5/2; 2.5Y 4/1, 4/2, or 5/2; 5Y 4/1, 5/1, or 5/2; or N 5/0. It has moist color of 10YR 2/1, 3/1, 3/2, or 4/2; 2.5Y 2/1, 3/1, or 3/2; 5Y 3/1 or 3/2; or N 3/0. Texture is clay loam, stony clay, or clay. Structure is typically granular or fine blocky in the upper few inches. Typically, some diagonal ped faces occur in the lower part. Reaction is neutral to moderately alkaline, and alkalinity generally increases with depth.

The Bss horizon has dry color of 10YR 2/1, 3/1, 3/2, 4/1, 4/2, 4/3, 5/3, 7/1, or 7/2; 2.5Y 4/3, 5/2, or 6/4; or 5Y 4/2, 4/3, 5/2, 5/3, 6/2, or 6/3. It has moist color of 10YR 2/1, 2/2, 3/1, 3/2, 5/3, or 6/3; 2.5Y 3/2, 3/3, or 4/4; or 5Y 3/2, 4/4, 5/1, or 5/6. Clay content is 40 to 60 percent. Intersecting slickensides occur in some part.

The Bkss and/or Bk horizons have dry color of 10YR 2/2, 3/1, 3/2, 4/1, 4/2, 4/3, 5/3, 7/1, or 7/2; 2.5Y 4/3, 4/4, 5/2, or 6/4; or 5Y 4/2, 4/3, 5/2, 5/3, 6/2, or 6/3. They have moist color of 10YR 2/1, 2/2, 3/1, 3/2, 5/3, or 6/3; 2.5Y 2/2, 3/2, 3/3, or 4/4; or 5Y 3/2 or 5/1. Texture is silty clay loam, gravelly clay, or clay. In some pedons, the horizons have intersecting slickensides. Segregated carbonates occur as seams, filaments, or soft masses.

The R horizon is fractured, fine grained greenish gray serpentine.

Cropley Series

The Cropley series consists of very deep, well drained soils that formed in alluvium from sandstone (fig. 25). Cropley soils are on alluvial fans and in basins (fig. 26). Slopes range from 0 to 9 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Aridic Haploxererts

Typical Pedon

Cropley clay, 2 to 9 percent slopes; Santa Clara County, California; Ed Levin County Park, City of Milpitas, west of Sandy Wool Lake, west of the main road in the field, west of the curve in the road to the middle of the field, on a west-facing 1 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 5 S., R. 1 E.; at an elevation of 165 meters; UTM Zone 10, Northing 4146038, Easting 600126, NAD83; USGS quadrangle: Calaveras Reservoir, California. When described, the soil was moist to a depth of 28 centimeters and dry below. (Colors are for dry soil unless otherwise noted.)

A1—0 to 4 inches (0 to 9 centimeters); very dark gray (10YR 3/1), broken face, clay, black (10YR 2/1), broken face, moist; 45 percent clay; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; many very fine tubular pores; slightly acid, pH 6.2 by pH meter 1:1 water; clear smooth boundary.

A2—4 to 11 inches (9 to 28 centimeters); very dark gray (10YR 3/1), broken face, clay, black (10YR 2/1), broken face, moist; 50 percent clay; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; neutral, pH 6.9 by pH meter 1:1 water; clear smooth boundary.

Bss1—11 to 24 inches (28 to 61 centimeters); dark gray (2.5Y 4/1), broken face, clay, black (2.5Y 2.5/1), broken face, moist; 50 percent clay; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; 20 percent pressure faces on slickensides and 70 percent clay films on all faces of peds; slightly alkaline, pH 7.6 by pH meter 1:1 water; gradual smooth boundary.

Bss2—24 to 33 inches (61 to 84 centimeters); dark gray (2.5Y 4/1), broken face, clay, black (2.5Y 2.5/1), broken face, moist; 50 percent clay; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; 30 percent pressure faces on slickensides; slightly alkaline, pH 7.8 by pH meter 1:1 water; gradual smooth boundary.

Bss3—33 to 51 inches (84 to 130 centimeters); dark gray (2.5Y 4/1), broken face, clay, very dark gray (2.5Y 3/1), broken face, moist; 50 percent clay; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; 40 percent pressure faces on slickensides; 10 percent irregular carbonate masses in matrix; very slight effervescence; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary.

BCk1—51 to 57 inches (130 to 146 centimeters); brown (7.5YR 5/3), broken face, sandy clay loam, brown (7.5YR 4/3), broken face, moist; 32 percent clay; moderate medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; many very fine tubular pores; 10 percent clay films on all faces of peds; 10 percent irregular carbonate masses in matrix; strong effervescence; moderately alkaline, pH 8.0 by pH meter 1:1 water; clear smooth boundary.

BCk2—57 to 63 inches (146 to 160 centimeters); brown (7.5YR 5/3), broken face, sandy clay loam, brown (7.5YR 4/3), broken face, moist; 28 percent clay;

Figure 25.—Representative profile of the Cropley series. This clay soil has deep cracks visible to about 1 meter. Brown sandy clay loam below a depth of 130 centimeters has white carbonate masses. Surface cracks can be 5 centimeters wide during summer and close during the winter rainy season.

Figure 26.—Landscape of Cropley soils in Ed Levin County Park east of Milpitas. Cropley soils are on the alluvial fans and basins in the foreground between the hills. Alo and Altamont soils occur on the smooth hills. A gravel mine is visible in the distance.

moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and slightly plastic; common very fine tubular pores; 10 percent clay films on all faces of peds; 1 percent subangular indurated 2- to 75-millimeter mixed rock fragments; strong effervescence; moderately alkaline, pH 8.0 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section averages 35 to 50 percent clay and 0 to 10 percent rock fragments, mostly gravel. Mineralogy is smectitic. The soils are calcareous in the lower Bss horizon and the Bk horizon but are noncalcareous in some pedons. Organic matter content ranges from 1 to 4 percent to a depth of 25 centimeters. Surface-initiated reversible cracks 1 to 5 centimeters wide extend to a depth of 100 centimeters from about May 1 to November 1 (about 180 days) when the soil is not irrigated. Slickensides range from 10 to 40 percent in the Bss horizon at a depth of 28 to 130 centimeters. Electrical conductivity by the corrected saturated paste method ranges from 0.4 to 2.6 S/m.

The A horizon has dry color of 10YR 4/2, 3/2, or 3/1 and moist color of 10YR 3/2, 2/2, 3/1, or 2/1. Texture is clay loam or clay. Clay content ranges from 35 to 50 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The Bss horizon has dry color of 10YR 5/3, 4/2, or 4/1 or 2.5Y 6/2, 5/2, or 4/1 and moist color of 10YR 4/1, 3/3, 3/2, or 3/1 or 2.5Y 4/2, 3/2, 3/1, or 2.5/1. Texture is clay

loam or clay. Clay content ranges from 35 to 50 percent. Rock fragments range from 0 to 10 percent gravel. Reaction ranges from pH 6.6 to 8.4.

The BCk horizon has dry color of 10YR 6/3, 5/3, or 4/3; 7.5YR 5/3 or 4/2; or 2.5Y 6/2. It has moist color of 10YR 5/3, 4/3, or 3/3; 7.5YR 4/3 or 4/2; or 2.5Y 4/2. Texture is sandy clay loam, clay loam, or clay. Clay content ranges from 27 to 45 percent. Rock fragments range from 0 to 10 percent gravel. Soft masses of carbonates range from 0 to 10 percent. Reaction ranges from pH 7.3 to 8.4.

Cumulic Haloxerolls

Cumulic Haploxerolls consist of very deep, well drained soils that formed in gravelly alluvium from mixed rock sources (fig. 27). These soils are on flood plains (fig. 28). Slopes range from 1 to 5 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, thermic Cumulic Haploxerolls

Typical Pedon

Cumulic Haploxerolls, 1 to 5 percent slopes; Santa Clara County, California; Singer County Park, San Jose, near Camden Avenue and Graystone Lane, on the bank of Alamitos Creek north of the footbridge on the east bank cut, on a north-facing 1 percent slope under a cover of oak, California bay laurel, and poison oak, in a nonsectionized area of T. 8 S., R. 1 E.; at an elevation of 223 feet; UTM Zone 10, Northing 4120251, Easting 601664, NAD83; USGS quadrangle: San Jose East, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Cumulic Haploxerolls in this survey area because of the highly variable nature of these soils.

A1—0 to 6 inches (0 to 15 centimeters); brown (10YR 4/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 18 percent clay; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; 5 percent rounded indurated 75- to 210-millimeter mixed rock fragments and 40 percent rounded indurated 2- to 75-millimeter mixed rock fragments; strong effervescence, by HCl, 1 normal; neutral (pH 7.3 by pH meter 1:1 water); clear smooth boundary.

A2—6 to 17 inches (15 to 44 centimeters); brown (10YR 5/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 17 percent clay; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; 5 percent rounded indurated 75- to 210-millimeter mixed rock fragments and 45 percent rounded indurated 2- to 75-millimeter mixed rock fragments; strong effervescence, by HCl, 1 normal; slightly alkaline (pH 7.6 by pH meter 1:1 water); abrupt smooth boundary.

A3—17 to 33 inches (44 to 85 centimeters); brown (10YR 4/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 17 percent clay; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and few medium roots; many very fine interstitial pores; 5 percent rounded indurated 75- to 210-millimeter mixed rock fragments and 35 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline (pH 7.6 by pH meter 1:1 water); abrupt smooth boundary.

2Ab—33 to 45 inches (85 to 114 centimeters); brown (10YR 4/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 17 percent clay;

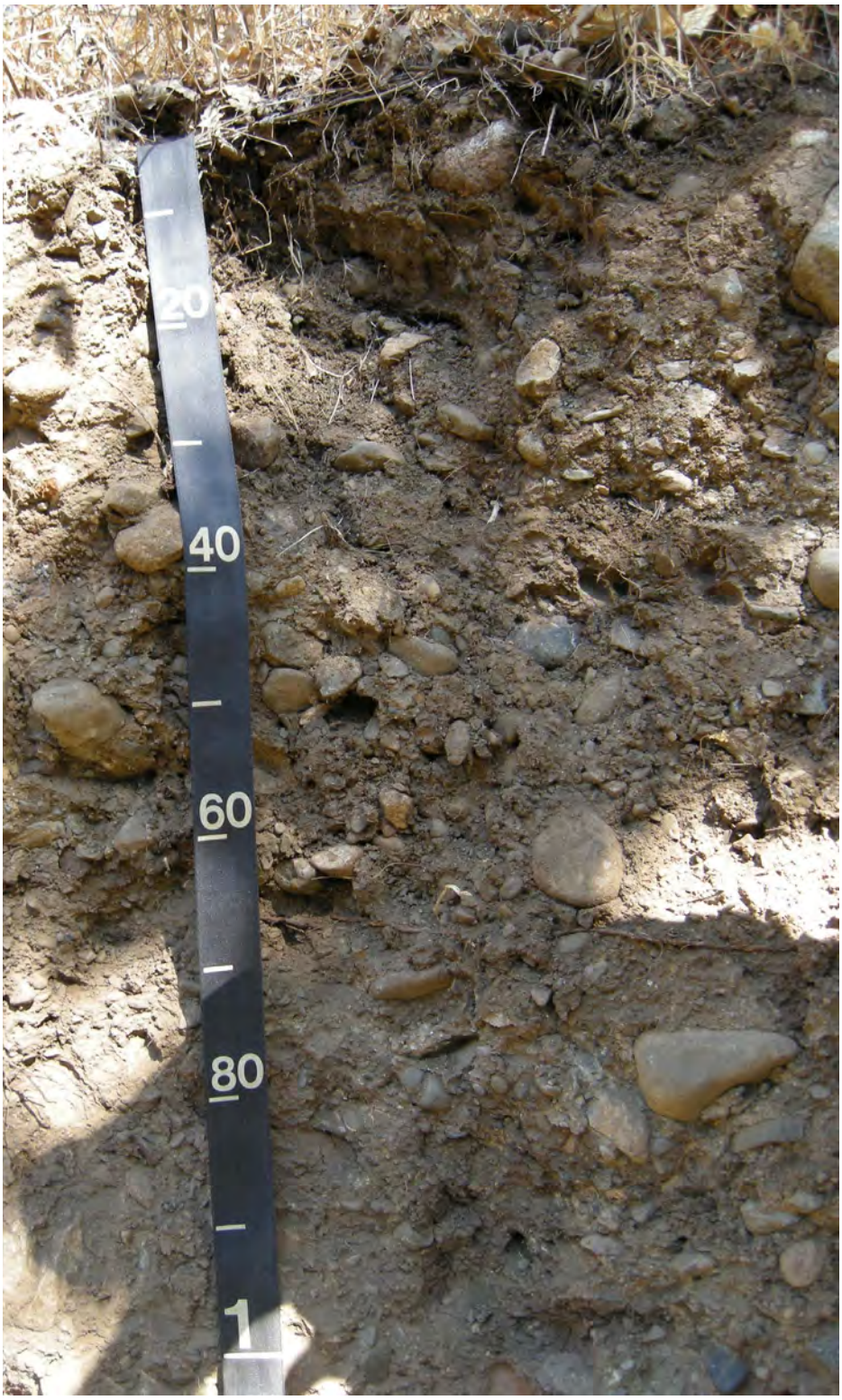


Figure 27.—Representative profile of Cumulic Haploxerolls. It is located on a bank cut of Alamitos Creek. The soil has a large amount of rounded gravel and cobbles throughout. It is sandy loam between the fragments.

Figure 28.—Landscape of Cumulic Haploxerolls in Pfeiffer Park in south San Jose. Dense vegetation of oaks and understory plants grows along Alamitos Creek. Flooding occurs along the main channel but is controlled by upstream dams and levees. Prior to flood control, flooding regularly deposited soil material in some areas and removed materials in other areas along the creek.

moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent rounded indurated 75- to 210-millimeter mixed rock fragments and 35 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline (pH 7.6 by pH meter 1:1 water); abrupt smooth boundary.

3Cb—45 to 59 inches (114 to 150 centimeters); brown (10YR 4/3), broken face, extremely gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 14 percent clay; massive; soft, very friable, slightly sticky and nonplastic; many very fine interstitial pores; 5 percent rounded indurated 75- to 210-millimeter mixed rock fragments and 65 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline (pH 7.6 by pH meter 1:1 water).

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about May 1 to November 1 (about 180 days). The particle-size control section averages 10 to 27 percent clay and 35 to 50 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are calcareous in some horizons in most pedons. Rock fragments on the surface range from 10 to 30 percent and are mostly gravel.

The A horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 3/3. Texture is sandy loam. Clay content ranges from 12 to 22 percent. Rock fragments range from

35 to 50 percent and are mostly gravel with 0 to 5 percent cobbles. Reaction ranges from pH 7.2 to 8.0.

The 2A and 2C horizons have dry color of 10YR 4/3 and moist color of 10YR 3/3. Texture is sandy loam. Clay content ranges from 10 to 27 percent. Rock fragments range from 35 to 70 percent and are mostly gravel with 0 to 5 percent cobbles. Reaction ranges from pH 7.5 to 8.0.

Diablo Series

The Diablo series consists of deep, well drained soils that developed in residuum from sandstone and shale. Diablo soils are on hills and mountains. Slopes range from 5 to 50 percent. The mean annual air temperature is about 59 degrees F, and the mean annual precipitation is about 25 inches.

Taxonomic Classification

Fine, smectitic, thermic Aridic Haploxererts

Typical Pedon

Diablo silty clay; Alameda County, California; approximately 3 miles northeast of Livermore, in a grain field, 1,325 feet east and 275 feet north of the southwest corner of section 25, T. 2 S., R. 1 E. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 6 inches (0 to 15 centimeters); dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; the immediate very thin surface crust dries light gray and gray (5Y 6/1 or 7/1); the surface 1 to 3 inches has strong medium granular structure, the remainder has strong coarse and medium blocky structure; very hard, very firm, sticky and very plastic; common fine roots mainly along faces of peds; few very fine tubular pores; neutral; clear wavy boundary.

A—6 to 15 inches (15 to 38 centimeters); dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic and moderate coarse blocky structure; very hard, very firm, sticky and very plastic; few fine roots mainly along faces of peds; noneffervescent except for an occasional small white lime nodule; mildly alkaline; clear smooth boundary.

Bkss1—15 to 26 inches (38 to 66 centimeters); finely mixed gray and olive gray (5Y 5/1 and 5/2) silty clay, dark gray and olive gray (5Y 4/1 and 4/2) moist; moderate coarse prismatic and medium blocky structure; very hard, very firm, sticky and very plastic; few fine roots along faces of peds; few fine and very fine tubular pores; numerous slickensides; slightly effervescent in matrix, few strongly effervescent white lime nodules; moderately alkaline; clear wavy boundary.

Bkss2—26 to 32 inches (66 to 81 centimeters); finely mixed gray and olive gray (5Y 5/1 and 5/2) silty clay, dark gray and olive gray (5Y 4/1 and 4/2) moist; weak coarse prismatic and weak medium blocky structure; very hard, very firm, sticky and very plastic; few fine roots mainly along faces of peds, roots distinctly flattened in appearance; few fine and very fine tubular pores; numerous slickensides; slightly effervescent matrix, few strongly effervescent small hard white lime nodules; moderately alkaline; diffuse smooth boundary. (4 to 8 inches thick)

BCk—32 to 42 inches (81 to 107 centimeters); light olive gray (5Y 6/2) silty clay, olive gray (5Y 5/2) moist; weak medium subangular blocky structure; very hard, very firm, slightly sticky and plastic; few fine roots; few fine and very fine tubular pores; many white lime films and soft segregations; moderately alkaline; clear wavy boundary. (10 to 16 inches thick)

C—42 to 50 inches (107 to 127 centimeters); fine and medium mottled-appearing olive gray and light olive gray (5Y 5/2 and 6/2) silty clay loam, olive gray (5Y 5/2 or 4/2) moist; weak fine and medium subangular blocky structure; very hard, very firm, slightly sticky and plastic; few fine roots; few fine and very fine tubular pores; many

shale fragments; strongly effervescent soft white filaments; soft and hard lime nodules; moderately alkaline; clear smooth boundary. (8 to 16 inches thick)
Cr—50 to 60 inches (127 to 152 centimeters); light olive gray (5Y 6/2) slightly effervescent shale and fine grained sandstone with white films on facings.

Range in Characteristics

Depth to the Cr layer ranges from 40 to 80 inches. Slopes are complex and more than 5 percent. The mean annual soil temperature is about 60 to 64 degrees F. When dry, the soils have cracks ½ inch to 2 inches wide from the surface to a depth of 20 to 40 inches. Cracks close with soil wetting beginning in late October to late November and remain closed until the soil dries in April to early June. Cracks remain open the rest of the year.

The A horizons, the Bssk horizons, and all but some of the lower C horizons have more than 30 percent clay; most horizons have 45 to 60 percent clay. Slickensides occur in the Bssk horizons.

The A horizon, or the soil from the surface to a depth of 12 to 30 inches, is gray, dark gray, or very dark gray. Texture is heavy clay loam, silty clay, or clay and is slightly acid to moderately alkaline. The horizon is noncalcareous, except in the lower part in a few pedons. The lower part of the A horizon has mixed colors. Chroma is less than 1.5 in some part and ranges from 2 to 4 in other parts. The A horizon is moderately alkaline and calcareous in some part.

The C horizon is grayish brown, dark grayish brown, brown, light yellowish brown, or light olive brown. Texture is clay loam, silty clay, or clay. The horizon contains fragments of shale or other rock in some pedons in amounts up to 30 percent, particularly just above the rock contact. It is calcareous, and in most pedons most of the lime is small segregations. In a few pedons the horizon has small lime concretions.

Elder Series

The Elder series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 29). Elder soils are on flood plains (fig. 30). Slopes range from 0 to 2 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Coarse-loamy, mixed, superactive, thermic Cumulic Haploxerolls

Typical Pedon

Elder fine sandy loam, protected, 0 to 2 percent slopes; Santa Clara County, California; McClellan Park, City of Cupertino, 150 feet south of Stevens Creek, north of the sundial, on a south-facing 2 percent slope with a disked surface, in section 22, T. 7 S., R. 1 W.; at an elevation of 308 feet; UTM Zone 10, Northing 4130212, Easting 0582990, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for moist soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 2 centimeters); slightly decomposed plant material; abrupt smooth boundary.
A1—1 to 5 inches (2 to 12 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; strong medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few fine tubular and common fine interstitial pores; neutral, pH 6.9 by pH meter 1:1 water; clear smooth boundary.
A2—5 to 18 inches (12 to 46 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; moderate

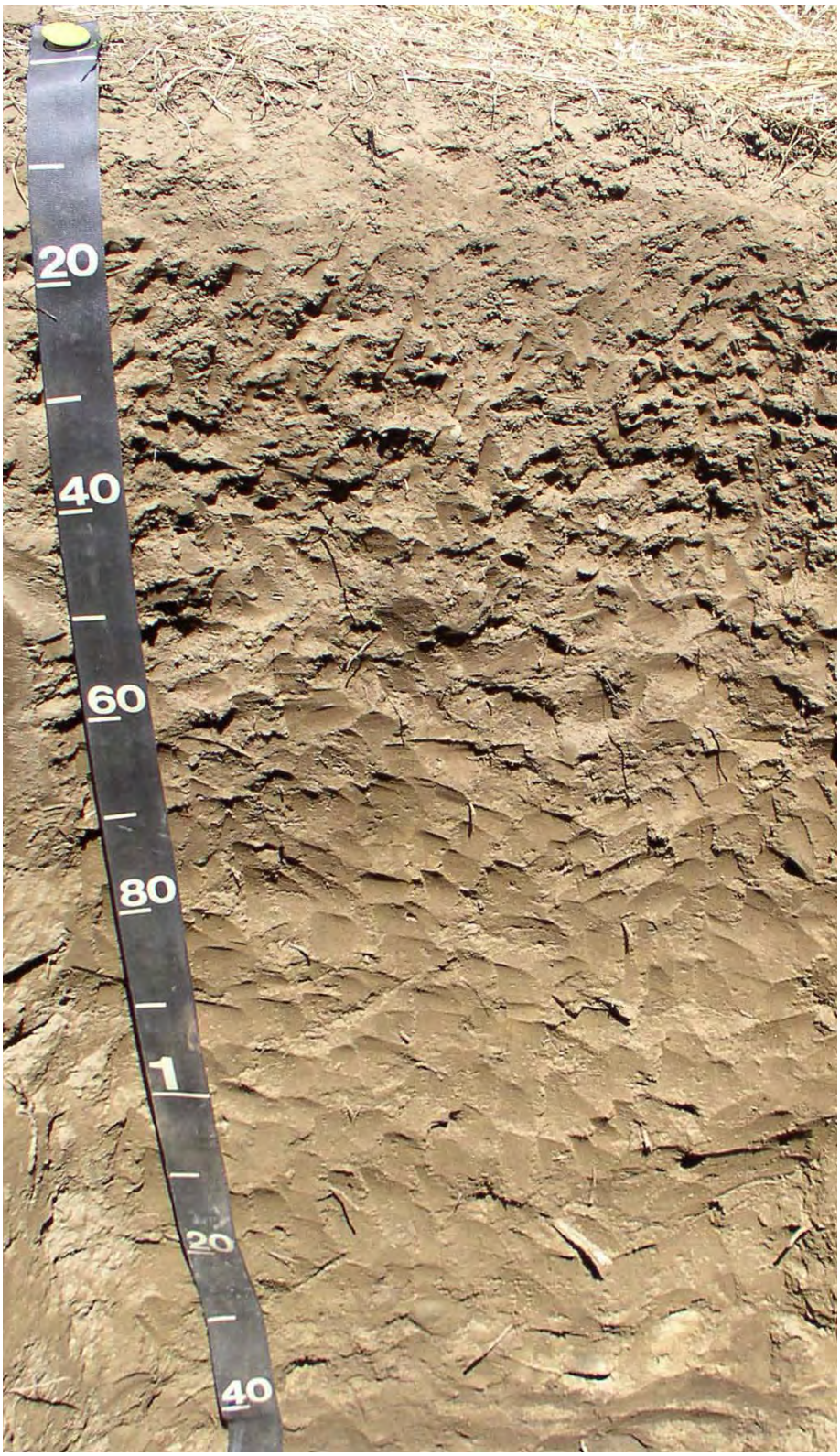


Figure 29.—Representative profile of the Elder series. The soil is a very deep deposit of sandy loam with very few rounded fragments. Dark brown colors extend to a depth of more than 2 meters.

Figure 30.—Landscape of Elder soils. Photo was taken in McClellan Ranch Park, Cupertino, along the flood plain of Stevens Creek. These soils are the most productive soils in the survey area. They are very deep, have very friable sandy loam texture, and have high fertility. Historically, Elder soils were flooded annually but upstream dams have eliminated most flooding.

medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few fine interstitial pores; neutral, pH 6.8 by pH meter 1:1 water; clear smooth boundary.

A3—18 to 31 inches (46 to 80 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few very fine interstitial pores; neutral, pH 7.0 by pH meter 1:1 water; gradual smooth boundary.

A4—31 to 51 inches (80 to 130 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and few coarse roots; few very fine interstitial pores; neutral, pH 7.0 by pH meter 1:1 water; abrupt smooth boundary.

2Ab1—51 to 55 inches (130 to 140 centimeters); brown (10YR 4/3), broken face, fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 13 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few coarse roots; few very fine interstitial pores; 10 percent rounded indurated 20- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.7 by pH meter 1:1 water; abrupt smooth boundary.

2Ab2—55 to 67 inches (140 to 170 centimeters); brown (10YR 4/3), broken face, fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 13 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few coarse roots; few very fine interstitial pores; slight effervescence,

by HCl, 1 normal; slightly alkaline, pH 7.7 by pH meter 1:1 water; abrupt smooth boundary.

2Ab3—67 to 85 inches (170 to 215 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 13 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few coarse roots; few very fine interstitial pores; slightly alkaline, pH 7.7 by pH meter 1:1 water; abrupt smooth boundary.

2Bw—85 to 87 inches (215 to 220 centimeters); 50 percent yellowish brown (10YR 5/6), broken face, and 50 percent grayish brown (10YR 5/2), broken face, fine sandy loam, 50 percent dark yellowish brown (10YR 3/6), broken face, moist and 50 percent brown (10YR 4/3), broken face, moist; 13 percent clay; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine interstitial pores; slightly alkaline, pH 7.5 by pH meter 1:1 water.

Range in Characteristics

Depth to a buried A horizon (if it occurs) is 130 to 150 centimeters. The mean annual soil temperature is 58 to 62 degrees F. The soil moisture control section is dry in all parts from about July 1 to October 15 (about 105 days). The particle-size control section averages 15 to 18 percent clay and 0 to 2 percent rock fragments, mostly rounded gravel. Mineralogy is mixed. Organic matter content ranges from 1 to 3 percent to a depth of 46 centimeters.

The A1 and A2 horizons have dry color of 10YR 4/3 or 5/3 and moist color of 10YR 3/2 or 3/3. Texture is fine sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 0 to 2 percent rounded gravel. Reaction ranges from pH 6.6 to 7.3.

The A3 and A4 horizons have dry color of 10YR 4/3 or 5/3 and moist color of 10YR 3/3. Texture is fine sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 0 to 2 percent rounded gravel. Reaction ranges from pH 6.6 to 7.3.

The 2Ab and 2Bw horizons have dry color of 10YR 4/3, 5/2, or 5/6 and moist color of 10YR 3/2, 3/3, or 3/6. Texture is fine sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 0 to 10 percent rounded gravel. Reaction ranges from pH 7.3 to 7.8.

Elkhorn Series

The Elkhorn series consists of very deep, well drained soils that formed in material weathered from alluvium from mixed rock sources. Elkhorn soils are on coastal terraces and have slopes of 2 to 50 percent. The mean annual precipitation is about 18 inches, and the mean annual air temperature is about 58 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Elkhorn fine sandy loam; Monterey County, California; about 4 miles north of Moss Landing, 2,600 feet west and 3,000 feet north of Springhill Road from its intersection with Highway 1, in a cultivated area. (Colors are for dry soil unless otherwise noted.)

Ap1—0 to 9 inches (0 to 23 centimeters); brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; few very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

Ap2—9 to 17 inches (23 to 43 centimeters); brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate coarse angular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and few medium roots; few very fine and fine tubular and few very fine interstitial pores; slightly acid (pH 6.5); clear smooth boundary.

A—17 to 26 inches; (43 to 66 centimeters); brown (10YR 5/3) heavy fine sandy loam, dark brown (10YR 3/3) moist; moderate medium and coarse angular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many medium, fine, and very fine tubular and many very fine interstitial pores; numerous wormcasts; moderately acid (pH 5.8); clear irregular boundary.

Bt—26 to 46 inches (66 to 117 centimeters); brown (7.5YR 5/4) sandy clay loam, mixed dark brown and reddish brown (7.5YR 4/4 and 5YR 4/4) moist; massive; very hard, firm, sticky and slightly plastic; few thin discontinuous clay films lining pores; many medium and coarse weakly cemented shot that are not magnetic but effervescent in solution of hydrogen peroxide; moderately acid (pH 6.0); gradual wavy boundary.

C—46 to 63 inches (117 to 160 centimeters); strong brown (7.5YR 5/6) fine sandy loam, mixed strong brown and dark brown (7.5YR 5/6 and 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few coarse tubular and few very fine interstitial pores; few thin distinct clay films lining pores; few medium faint weakly cemented coarse shot that are not magnetic but effervescent in solution of hydrogen peroxide; slightly acid (pH 6.5).

Range in Characteristics

The solum is 42 to 60 inches thick. The soil between depths of 6 and 18 inches becomes moist in some part in November or early December and remains moist until May. The mean annual soil temperature is between 59 and 60 degrees F. The average summer soil temperature is about 65 degrees F, and the mean winter soil temperature is about 54 degrees F. Base saturation is 75 to 95 percent in all parts. Gravel, shale fragments, and other rock fragments are less than 15 percent in the A and Bt horizons. Organic matter content ranges from 2 to 6 percent in the upper 20 inches and decreases regularly to less than 1 percent at 40 inches below the surface.

The Ap and A horizons are grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown (10YR 5/2, 4/2, 3/2, 5/3, or 4/3). Texture is sandy loam, fine sandy loam, or loam. The horizons have granular, subangular blocky, or angular blocky structure. Reaction ranges from neutral to moderately acid. Some pedons have a few dark reddish brown or brown coarse shot or concretions in the lower A horizon. A transitional AB horizon or BA horizon, or both, occur between the A horizon and the Bt horizon.

The Bt horizon is dark brown, brown, pale brown, very pale brown, grayish brown, light brownish gray, light gray, dark yellowish brown, or yellowish brown (10YR 4/3, 5/3, 6/3, 6/2, 7/2, 4/4, or 5/4) or brown, dark brown, or strong brown (7.5YR 3/2, 4/2, 5/2, 4/4, 5/4, or 5/6). Reaction ranges from neutral to moderately acid. Few or common firm iron manganese shot, concretions, or flakes occur in some part of this horizon.

A buried sandy clay loam or clay layer occurs below the Bt horizon in some pedons.

The C horizon is brown, strong brown, or reddish yellow (7.5YR 5/4, 5/6, or 6/6) or pale brown, yellowish brown, light yellowish brown, or brownish yellow (10YR 6/3, 6/4, 5/4, 6/6, or 5/6). Texture is loamy sand, loamy fine sand, sandy loam, or fine sandy loam. Reaction ranges from moderately acid to neutral.

Elpaloalto Series

The Elpaloalto series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 31). Elpaloalto soils are on alluvial fans and flood plains. Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-silty, smectitic, superactive, thermic Pachic Haploxerolls

Typical Pedon

Elpaloalto clay loam in an area of Urban land-Elpaloalto complex, 0 to 2 percent slopes; Santa Clara County, City of Palo Alto, El Camino Park, in a plant bed area along El Camino Real, north of the park entrance, north of a large oak tree, on an east-facing 2 percent slope under a cover of oak and mulch, in a nonsectionized area of T. 6 S., R. 3 W.; at an elevation of 21 meters; UTM Zone 10, Northing 4144613, Easting 573509, NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 8 inches (0 to 21 centimeters); very dark grayish brown (10YR 3/2) slightly decomposed plant material, very dark brown (10YR 2/2) moist; weak fine granular and weak medium granular structure; loose, loose, nonsticky and nonplastic; many fine irregular and many medium irregular pores; neutral, pH 6.7 by pH meter 1:1 water; abrupt smooth boundary.

A—8 to 17 inches (21 to 42 centimeters); brown (10YR 4/3), broken face, clay loam, very dark brown (10YR 2/2), broken face, moist; 24 percent clay; moderate coarse subangular blocky and moderate medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; common very fine roots; many very fine irregular pores; slightly acid, pH 6.3 by pH meter 1:1 water; clear smooth boundary.

Bw1—17 to 26 inches (42 to 65 centimeters); brown (10YR 5/3), broken face, silty clay loam, very dark brown (10YR 2/2), broken face, moist; 34 percent clay; moderate coarse subangular blocky and moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; common fine irregular, common very fine tubular, and many very fine irregular pores; neutral, pH 6.7 by pH meter 1:1 water; clear smooth boundary.

Bw2—26 to 35 inches (65 to 90 centimeters); brown (10YR 5/3), broken face, silty clay loam, very dark brown (10YR 2/2), broken face, moist; 35 percent clay; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; few coarse and few very fine roots; many very fine irregular and common very fine tubular pores; neutral, pH 6.9 by pH meter 1:1 water; gradual smooth boundary.

Bw3—35 to 47 inches (90 to 120 centimeters); brown (10YR 5/3), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 35 percent clay; moderate medium subangular blocky structure; very hard, friable, very sticky and very plastic; few medium and few coarse roots; many very fine irregular and common very fine tubular pores; neutral, pH 7.1 by pH meter 1:1 water; clear smooth boundary.

Bw4—47 to 71 inches (120 to 181 centimeters); brown (10YR 5/3), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 35 percent clay; moderate medium subangular blocky structure; very hard, friable, very sticky and very plastic; few medium and few coarse roots; many very fine irregular and common very fine tubular pores; neutral, pH 7.0 by pH meter 1:1 water; clear smooth boundary.

Figure 31.—Representative profile of the Elpaloalto series. Photo was taken in El Camino Park in Palo Alto. The soil has a thick layer of shredded bark on the surface. The profile is mostly brown silty clay loam that is well drained. Elpaloalto soils are very fertile but can be difficult to work by hand when dry unless large amounts of organic matter are added.

C—71 to 94 inches (181 to 240 centimeters); brown (7.5YR 4/3), broken face, silty clay loam, very dark brown (7.5YR 2.5/3), broken face, moist; 37 percent clay; weak fine subangular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; common fine irregular and many very fine irregular pores; neutral, pH 7.3 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 58 to 62 degrees F. The soil moisture control section is dry in all parts from about July 1 to October 1 (about 120 days). The particle-size control section is 25 to 100 centimeters thick and averages 27 to 35 percent clay. Rock fragments range from 0 to 2 percent and are rounded and mostly gravel. Mineralogy is mixed.

The A horizon has dry color of 10YR 4/3, 4/2, or 3/2 or 2.5Y 5/3 or 5/2 and moist color of 10YR 3/3 or 2/2 or 2.5Y 3/2 or 3/1. Organic matter content ranges from 1 to 4 percent to a depth of 17 centimeters. Texture is silt loam, sandy clay loam, clay loam, or silty clay loam. Clay content ranges from 20 to 35 percent. Rock fragments range from 0 to 2 percent gravel. Reaction ranges from pH 5.6 to 7.3.

The Bw horizon has dry color of 10YR 6/3 or 5/3 or 2.5Y 5/3 or 5/2 and moist color of 10YR 4/3, 3/3, or 3/2 or 2.5Y 4/2 or 3/1. Texture is silty clay loam, clay loam, or silt loam. Clay content ranges from 27 to 40 percent. Rock fragments range from 0 to 2 percent gravel. Reaction ranges from pH 5.6 to 8.4.

The C horizon has dry color of 10YR 6/4, 6/3, 5/4, or 4/4 or 7.5YR 4/3 and moist color of 10YR 4/4, 4/3, or 4/2 or 7.5YR 2.5/3. Texture is silty clay loam or loam. Clay content ranges from 27 to 40 percent. Rock fragments range from 0 to 2 percent gravel. Reaction ranges from pH 5.6 to 8.4.

Elsman Series

The Elsman series consists of very deep, well drained soils that formed in colluvium over residuum from sandstone and shale (fig. 32). Elsman soils are on mountain slopes (fig. 33). Slopes range from 8 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Typic Haploxerepts

Typical Pedon

Elsman gravelly coarse sandy loam in an area of Elsman-Maymen, 50 to 75 percent slopes; Santa Clara County, California; Uvas Canyon County Park, Alec Canyon Trail, about 200 meters north of Old Logging Camp, on a north-facing (320 degree) 57 percent slope, in section 7, R. 2 E., T. 10 S.; at an elevation of 427 meters; UTM Zone 10, Northing 4104171, Easting 0607601, NAD83; USGS quadrangle: Loma Prieta, California. When described on September 11, 2007, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 3 inches (0 to 8 centimeters); very dark brown (10YR 2/2), broken face, slightly decomposed plant material consisting of leaves and twigs, black (10YR 2/1), broken face, moist; about 100 percent fiber and 90 percent rubbed; loose, nonsticky and nonplastic; moderately acid, pH 6.0 by Chlorophenol red; abrupt smooth boundary.

A—3 to 7 inches (8 to 17 centimeters); yellowish brown (10YR 5/4), broken face, gravelly coarse sandy loam, dark yellowish brown (10YR 3/4), broken face, moist; 12 percent clay; weak fine subangular blocky structure parting to weak fine granular and weak medium subangular blocky structure parting to weak medium

Figure 32.—Representative profile of the Elsman series. Numerous gravel and cobbles occur throughout this very deep soil. The soil is loamy-skeletal and well drained. The C horizon starts at a depth of 82 centimeters.

Figure 33.—Landscape of Elsman soils. Photo was taken at the type location on Alec Canyon Trail in Uvas Canyon County Park. Oaks and Douglas firs dominate the tree canopy with ferns, poison oak, and small trees in the understory. Slopes are steep in most areas.

granular; slightly hard, very friable, nonsticky and nonplastic; common fine and many very fine roots throughout; common fine and many very fine interstitial pores; 5 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 35 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.5 by Chlorophenol red; clear smooth boundary.

Bw1—7 to 15 inches (17 to 38 centimeters); brown (7.5YR 5/4), broken face, gravelly sandy loam, dark yellowish brown (10YR 3/4), broken face, moist; 18 percent clay; weak fine subangular blocky structure parting to weak fine granular and weak medium subangular blocky structure parting to weak medium granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine, common medium, and many very fine roots throughout; common fine and many very fine interstitial pores; 5 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 35 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.4 by Chlorophenol red; clear wavy boundary.

Bw2—15 to 24 inches (38 to 60 centimeters); brown (7.5YR 5/4), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 22 percent clay; weak medium subangular blocky and weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common fine, common medium, and many very fine roots throughout; common fine and many very fine interstitial pores; 5 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 40 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.2 by Chlorophenol red; clear wavy boundary.

Bt—24 to 32 inches (60 to 82 centimeters); yellowish brown (10YR 5/4), broken face, gravelly loam, brown (7.5YR 4/4), broken face, moist; 24 percent clay; weak medium subangular blocky and weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common fine, common medium, and common very fine roots throughout; common fine and many very fine interstitial pores; 10 percent patchy faint clay films on all faces of peds; 10 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 35 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; moderately acid, pH 5.8 by Chlorophenol red; clear wavy boundary.

C1—32 to 41 inches (82 to 105 centimeters); light yellowish brown (10YR 6/4), broken face, very gravelly loam, brown (7.5YR 5/4), broken face, moist; 22 percent clay; weak medium subangular blocky and weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common fine, common medium, and common very fine roots throughout; common fine and common very fine interstitial pores; 10 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 40 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.6 by Chlorophenol red; clear wavy boundary.

C2—41 to 57 inches (105 to 146 centimeters); very pale brown (10YR 7/4), broken face, gravelly loam, strong brown (7.5YR 4/6), broken face, moist; 22 percent clay; moderate medium subangular blocky and moderate fine subangular blocky structure; moderately hard, friable, moderately sticky and slightly plastic; common fine, common medium, and common very fine roots throughout; many very fine interstitial pores; 10 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 30 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.6 by Chlorophenol red; abrupt smooth boundary.

2Bt—57 to 66 inches (146 to 168 centimeters); light yellowish brown (10YR 6/4), broken face, gravelly loam, dark yellowish brown (10YR 4/4), broken face, moist; 26 percent clay; moderate medium subangular blocky and moderate fine subangular blocky structure; moderately hard, friable, moderately sticky and slightly plastic; common fine and common medium roots throughout; many very fine interstitial pores; 15 percent patchy faint clay films on all faces of peds; 5 percent subrounded strongly cemented 76- to 250-millimeter sandstone fragments and 25 percent angular strongly cemented 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.6 by Chlorophenol red.

Range in Characteristics

Depth is more than 150 centimeters. The mean annual soil temperature is about 56 to 60 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section is 25 to 100 centimeters thick and averages 12 to 28 percent clay and 35 to 50 percent rock fragments (mostly gravel and cobbles). Mineralogy is mixed. Organic matter content ranges from 4.0 to 6.0 percent to a depth of 15 centimeters.

The A horizon has dry color of 10YR 6/4, 6/3, or 5/4 and moist color of 10YR 4/4, 4/3, or 3/4. Texture is gravelly sandy loam, very gravelly coarse sandy loam, or gravelly loam. Clay content ranges from 6 to 17 percent. Rock fragments range from 15 to 50 percent and are mostly gravel and cobbles. Reaction ranges from pH 5.6 to 6.6.

The Bw horizon has dry color of 10YR 6/4 or 5/4 or 7.5YR 6/4 or 5/4 and moist color of 10YR 4/4 or 3/4. Texture is very gravelly sandy clay loam or very gravelly sandy loam. Clay content ranges from 12 to 28 percent. Rock fragments range from 30 to 50 percent and are mostly gravel and cobbles. Reaction ranges from pH 5.7 to 6.8.

The Bt horizon has dry color of 10YR 6/4 and moist color of 10YR 4/4. Texture is very gravelly sandy clay loam or very gravelly loam. Clay content is about 26 percent.

Rock fragments range from 35 to 50 percent and are mostly gravel and cobbles. Reaction ranges from pH 5.7 to 6.8.

The C horizon has dry color of 10YR 7/4 or 6/4 and moist color of 10YR 5/6, 5/4, 4/6, or 4/4. Texture is very gravelly sandy clay loam, very gravelly loam, or gravelly coarse sandy loam. Clay content ranges from 5 to 24 percent. Rock fragments range from 20 to 50 percent and are mostly gravel and cobbles. Reaction ranges from pH 5.6 to 6.4.

The Elsman component of some map units is considered a taxadjunct to the Elsman series because it has slightly fewer coarse fragments than typical for the soils. This difference, however, is considered interpretatively insignificant.

Embarcadero Series

The Embarcadero series consists of very deep soils that formed in alluvium from mixed rock sources (fig. 34). Embarcadero soils are naturally poorly drained but currently are artificially drained. These soils are on lower flood plains and in basins (fig. 35). Slopes range from 0 to 2 percent. The mean annual precipitation is about 13 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, mixed, active, calcareous, thermic Fluvaquentic Endoaquolls

Typical Pedon

Embarcadero clay loam in an area of Embarcadero silty clay loam, drained, 0 to 2 percent slopes; Santa Clara County, California; Baylands Park, City of Sunnyvale, wildlife area on the east side of the park, about 150 feet north of the gate, on a south-facing 1 percent slope under a cover of saltgrass, in a nonsectionized area of T. 6 S., R. 1 W.; at an elevation of 6 feet below sea level; UTM Zone 10, Northing 414075, Easting 058945, NAD83; USGS quadrangle: Milpitas, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

An—0 to 7 inches (0 to 19 centimeters); dark gray (10YR 4/1), broken face, clay loam, very dark gray (10YR 3/1), broken face, moist; 23 percent sand, 39 percent silt, and 38 percent clay; moderate coarse prismatic and moderate coarse angular blocky structure; very hard, friable, moderately sticky and slightly plastic; common coarse roots; few very fine tubular pores; strongly alkaline, pH 9.0 by pH meter 1:1 water; clear smooth boundary.

Bkn1—7 to 16 inches (19 to 40 centimeters); grayish brown (2.5Y 5/2), broken face, clay, very dark grayish brown (2.5Y 3/2), broken face, moist; 22 percent sand, 34 percent silt, and 45 percent clay; moderate coarse angular blocky and moderate coarse prismatic structure; very hard, friable, moderately sticky and moderately plastic; common coarse roots; few very fine tubular pores; 10 percent carbonate masses; very strongly alkaline, pH 9.9 by pH meter 1:1 water; abrupt wavy boundary.

Bkn2—16 to 26 inches (40 to 66 centimeters); silty clay that is 10 percent dark greenish gray (5GY 3/1), broken face, and 90 percent olive brown (2.5Y 4/3), broken face, moist; 14 percent sand, 43 percent silt, and 43 percent clay; moderate coarse angular blocky and moderate coarse prismatic structure; very hard, friable, moderately sticky and moderately plastic; few fine and few coarse roots; few very fine tubular pores; 2 percent carbonate masses; very strongly alkaline, pH 10.0 by pH meter 1:1 water; clear smooth boundary.

Bkn3—26 to 37 inches (66 to 95 centimeters); silty clay that is 40 percent olive brown (2.5Y 4/4), broken face, and 60 percent olive gray (5Y 4/2), broken face, moist; 8 percent sand, 42 percent silt, and 49 percent clay; moderately coarse angular blocky and prismatic sturcture; very hard, friable, moderately sticky and

Figure 34.—Representative profile of the Embarcadero series. It is located in Baylands Park in Sunnyvale. Texture is clayey. Deep cracks extend to a depth of more than 40 centimeters. Very dark grayish brown and very dark gray colors occur in the A horizon and the upper Bkn horizon. The lighter-colored subsoil has some visible carbonates near its upper boundary at a depth of about 40 centimeters. Embarcadero soils have very high soil pH, more than 9 in some places. Salinity and sodicity are moderate to high in places. These soils were in an evaporative area between the marsh and the basins but are now drained.

Figure 35.—Typical area of Embarcadero soils. Photo was taken at the Sunnyvale Baylands Park. Due to subsidence in the Santa Clara Valley, these soils have subsided approximately 2 to 6 feet where they are mapped near the San Francisco Bay marsh. Levees, which are required to keep out the bay waters (as Embarcadero soils are now below sea level), are visible in the background. Salt-tolerant plants make up a majority of the plant community. These soils have high salt content and soil pH.

moderately plastic; very strongly alkaline, pH 9.7 by pH meter 1:1 water; clear smooth boundary.

Bkn4—37 to 47 inches (95 to 120 centimeters); light yellowish brown (2.5Y 6/3), broken face, silty clay, light olive brown (2.5Y 5/3), broken face, moist; 11 percent sand, 40 percent silt, and 49 percent clay; massive; very hard, friable, moderately sticky and moderately plastic; few fine and few coarse roots; few very fine tubular pores; 30 percent carbonate masses; strong effervescence; very strongly alkaline, pH 9.6 by pH meter 1:1 water; clear smooth boundary.

Bkn5—47 to 61 inches (120 to 155 centimeters); light yellowish brown (2.5Y 6/3), broken face, clay loam, light olive brown (2.5Y 5/3), broken face, moist; 21 percent sand, 40 percent silt, and 39 percent clay; massive; very hard, friable, moderately sticky and moderately plastic; common very fine tubular pores; 30 percent carbonate masses; very strongly alkaline, pH 9.4 by pH meter 1:1 water; abrupt smooth boundary.

Bkn6—61 to 65 inches (155 to 164 centimeters); 70 percent light yellowish brown (2.5Y 6/3), broken face, silty clay, 70 percent light olive brown (2.5Y 5/3), broken face, moist; 8 percent sand, 41 percent silt, and 51 percent clay; massive; very hard, firm, moderately sticky and very plastic; common very fine tubular pores; 30 percent olive gray (5Y 5/2), moist, and light olive gray (5Y 6/2), dry, iron depletions; 10 percent carbonate masses and 20 percent carbonate concretions; very strongly alkaline, pH 9.3 by pH meter 1:1 water; abrupt smooth boundary.

BCg—65 to 98 inches (164 to 250 centimeters); 60 percent light yellowish brown (2.5Y 6/4), broken face, silty clay, 60 percent light olive brown (2.5Y 5/4), broken face, moist; 4 percent sand, 40 percent silt, and 56 percent clay; massive; very hard, firm, moderately sticky and very plastic; common very fine tubular pores; 40 percent gray (N 5/), moist, and light gray (N 6/), dry, iron depletions; 10 percent carbonate masses; strong effervescence; very strongly alkaline, pH 9.2 by pH meter 1:1 water.

Range in Characteristics

These soils formed under saturated soil conditions at or near sea level. Due to subsidence of the Santa Clara Valley, many areas of Embarcadero soils are now below sea level and would be flooded by bay waters if not protected by levees. Historic overdrafting of the ground water of the Santa Clara Valley has drained these soils, which are considered drained and protected today. The mean annual soil temperature is 62 to 64 degrees F. The soil moisture control section is dry in all parts from about June 15 to October 15 (about 120 days). The particle-size control section averages 35 to 50 percent clay.

Mineralogy is mixed. The soils are calcareous below the A horizon, and some A horizons may be calcareous. Carbonate masses occur below the A horizon and range from 2 to 60 percent. Carbonate concretions occur below a depth of 1 meter in some pedons. Organic matter content ranges from 1 to 3 percent to a depth of 40 centimeters. Salinity ranges from EC of 2 to 10, and it is as high as 50 in some areas. Sodicity ranges from SAR of 5 to 25.

The A horizon has dry color of 10YR 5/1, 4/1, or 3/1 or 2.5Y 5/2 and moist color of 10YR 3/1 or 2.5Y 4/2. Texture is silty clay loam or silty clay. Clay content ranges from 27 to 40 percent. Reaction ranges from pH 7.8 to 9.5.

The Bk1 horizon has dry color of 10YR 6/4, 6/2, 5/1, or 3/1 or 2.5Y 5/2 or 5/1 and moist color of 10YR 4/3, 4/2, or 2/1 or 2.5Y 5/3, 4/3, or 3/2. Texture is silty clay loam or silty clay. Clay content ranges from 35 to 50 percent. Reaction ranges from pH 7.8 to 9.5.

The Bk horizons, if they occur, have dry color of 10YR 8/1, 4/2, or 5/1; 5Y 8/1 or 5/1; or 2.5Y 7/3, 6/3, 5/3, or 5/1. They have moist color of 10YR 7/1, 4/1, or 3/2; 5Y 7/1, 5/1, or 4/1; or 2.5Y 5/3, 4/4, 4/3, or 3/1. Texture is sandy clay loam, silty clay loam, or silty clay. Clay content ranges from 35 to 50 percent. Reaction ranges from pH 7.8 to 9.5.

The Bn horizon (if it occurs) and BC horizon have dry color of 5Y 8/1 or 5/1 or 2.5Y 6/4 or 6/3 and moist color of 5Y 7/1 or 5/1 or 2.5Y 5/4, 5/3, or 4/4. Texture is sandy clay loam or silty clay. Clay content ranges from 35 to 50 percent. Redoximorphic features are iron depletions that have dry color of 10YR 5/2, 5Y 6/2, or 5GY 6/0 and moist color of 5Y 5/2, 5GY 5/0, or 2.5Y 4/2 or 4/1. Reaction ranges from pH 7.8 to 9.5.

Felton Series

The Felton series consists of very deep, well drained soils that formed in residuum from shale (fig. 36). Felton soils are on mountain slopes (fig. 37). Slopes range from 30 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Ultic Argixerolls

Figure 36.—Representative profile of the Felton series. Some rock fragments occur in the lower part of this very deep forest soil. Felton soils developed from siltstone and shale and are silt loam with subsoils of silty clay loam. The A horizon is darker brown than the subsoil below a depth of 47 centimeters. The subsoil is shadowed in the photo and appears darker.

Figure 37.—Landscape of Felton soils. Photo was taken at the type location along the White Oak Trail in the Skyline Open Space Preserve. The tree canopy is oaks and Douglas fir with bay laurel and an understory of ferns. Slopes are steep. The soft parent material is weathered easily, leaving few rock outcrops.

Typical Pedon

Felton fine sandy loam, 30 to 50 percent slopes; Santa Clara County, California; Skyline Open Space Preserve, east of Highway 35, south of the White Oak Trail gate, uphill about 30 meters, on a north-facing 45 percent slope under a cover of bay, oak, poison oak, and ferns, in the northwest corner of the northeast corner of section 22, T. 7 S., R. 3 W.; at an elevation of 2,006 feet; lat. 37 degrees 18 minutes 57.8 seconds N. and long. 122 degrees 10 minutes 32.7 seconds W., NAD83; USGS quadrangle: Mindego Hill, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 2 centimeters); slightly decomposed plant material; abrupt smooth boundary.

A—1 to 3 inches (2 to 8 centimeters); brown (10YR 5/3), broken face, fine sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine irregular pores; strongly acid, pH 5.6 by pH meter 1:1 water; clear smooth boundary.

ABt1—3 to 11 inches (8 to 28 centimeters); brown (10YR 5/3), broken face, silt loam, dark brown (10YR 3/3), broken face, moist; 26 percent clay; moderate medium angular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common fine and common very fine roots; many very fine irregular pores; 30 percent clay films on all faces of peds; strongly acid, pH 5.4 by pH meter 1:1 water; clear smooth boundary.

ABt2—11 to 19 inches (28 to 47 centimeters); brown (10YR 5/3), broken face, silty clay loam, brown (10YR 4/3), broken face, moist; 29 percent clay; strong medium angular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few very coarse and few very fine roots; many very fine irregular pores; 60 percent clay films on all faces of peds; 1 percent subrounded moderately cemented 20- to 75-millimeter sandstone fragments; very strongly acid, pH 5.1 by pH meter 1:1 water; clear smooth boundary.

Bt1—19 to 30 inches (47 to 77 centimeters); light yellowish brown (10YR 6/4), broken face, silty clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 30 percent clay; moderate fine angular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few coarse and few very fine roots; many very fine irregular pores; 80 percent clay films on all faces of peds; 5 percent brown (10YR 5/3), moist, iron depletions on faces of peds and 5 percent pale brown (10YR 6/3), dry, iron depletions on faces of peds; very strongly acid, pH 5.1 by pH meter 1:1 water; clear smooth boundary.

Bt2—30 to 57 inches (77 to 144 centimeters); 50 percent brownish yellow (10YR 6/6), broken face, and 50 percent gray (10YR 6/1), broken face, silty clay loam, 50 percent gray (10YR 5/1), broken face, moist and 50 percent yellowish brown (10YR 5/6), broken face, moist; 30 percent clay; weak fine angular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few medium and few coarse roots; many very fine irregular pores; 10 percent clay films on all faces of peds; 5 percent subrounded moderately cemented 20- to 75-millimeter sandstone fragments and 5 percent subrounded moderately cemented 75- to 120-millimeter sandstone fragments; strongly acid, pH 5.2 by pH meter 1:1 water; clear smooth boundary.

Bw—57 to 75 inches (144 to 190 centimeters); 40 percent gray (10YR 6/1), broken face, and 60 percent brownish yellow (10YR 6/6), broken face, silty clay loam, 60 percent yellowish brown (10YR 5/6), broken face, moist and 40 percent gray (2.5Y 5/1), broken face, moist; 28 percent clay; weak fine angular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common fine and common very fine roots; many very fine irregular pores; 5 percent subrounded moderately cemented 20- to 75-millimeter sandstone fragments and 5 percent subrounded moderately cemented 75- to 120-millimeter sandstone fragments; strongly acid, pH 5.5 by pH meter 1:1 water; clear smooth boundary.

Cr—75 to 77 inches (190 to 195 centimeters); moderately cemented, fractured siltstone.

Range in Characteristics

Depth to weathered bedrock is more than 150 centimeters. The mean annual soil temperature is 55 to 59 degrees F. The soil moisture control section is dry in all parts from about July 1 to October 1 (about 90 days). The particle-size control section is 47 to 122 centimeters thick and averages 25 to 32 percent clay. Mineralogy is mixed. Organic matter content ranges from 7.5 to 1.5 percent to a depth of 47 centimeters. Base saturation by ammonium acetate, pH 7.0 ranges from 50 to 75 percent at a depth of 77 to 150 centimeters.

The A horizon has dry color of 10YR 5/3, 5/2, 4/3, or 4/2 and moist color of 10YR 3/4, 3/3, 3/2, or 2/2. Texture is loam, sandy loam, fine sandy loam, or very fine sandy loam. Clay content ranges from 13 to 22 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 4.5 to 6.0.

The ABt1 horizon has dry color of 10YR 5/3, 5/2, or 4/2 and moist color of 10YR 4/3, 3/3, 3/2, or 2/2. Texture is loam, silt loam, or sandy clay loam. Clay content ranges from 18 to 26 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 3.5 to 5.5.

The ABt2 horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 4/3, 3/4, 3/3, or 2/2. Texture is loam, silty clay loam, or sandy clay loam. Clay content ranges from 18 to 29 percent. Fragments range from 0 to 15 percent gravel. Reaction ranges from pH 3.5 to 5.5.

The Bt1 horizon has dry color of 10YR 6/6, 6/4, 6/3, 5/4, or 5/3 and moist color of 10YR 5/4, 4/4, 4/3, or 3/2. Texture is silt loam, fine sandy loam, clay loam, or silty clay loam. Clay content ranges from 18 to 32 percent. Redoximorphic features have dry color of 10YR 6/8, 6/6, or 6/3 and moist color of 10YR 5/6 or 5/3 and range from 5 to 50 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 3.5 to 5.5.

The Bt2 horizon has dry color of 10YR 6/6 or 5/3 and moist color of 10YR 5/4, 4/4, 4/3, or 3/2. Texture is loam, clay loam, or silty clay loam. Clay content ranges from 25 to 32 percent. Rock fragments range from 5 to 35 gravel and cobbles. Redoximorphic features have dry color of 10YR 6/8 or 6/3 or 7.5YR 5/8 and moist color of 10YR 5/6 or 5/3 and range from 5 to 50 percent. Reaction ranges from pH 4.5 to 5.5.

The Bw horizon has dry color of 10YR 6/6 or 6/4 or 7.5YR 6/4, 6/3, or 5/6 and moist color of 10YR 5/4 or 7.5YR 4/4 or 4/3. Texture is loam, clay loam, or silty clay loam. Clay content ranges from 26 to 32 percent. Rock fragments range from 5 to 35 percent gravel. Redoximorphic features have dry color of 10YR 6/8 or 6/3 and moist color of 10YR 5/3 and range from 5 to 10 percent. Reaction ranges from pH 3.5 to 5.5.

Flaskan Series

The Flaskan series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 38). Flaskan soils are on alluvial fans (fig. 39). Slopes range from 0 to 30 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Typic Argixerolls

Typical Pedon

Flaskan sandy loam in an area of Urban land-Flaskan complex, 0 to 2 percent slopes; Santa Clara County, California; the City of Sunnyvale, Historical Orchard on East Remington Avenue, on the southwest corner near the intersection, two tree rows from the south and three tree rows from the west, on a north-facing 2 percent slope under a cover of peach trees and bare cultivation, in section 1, T. 7 S., R. 1 W.; at an elevation of 150 feet; UTM Zone 10, Northing 4134719, Easting 0586373, NAD83; USGS quadrangle: Mountain View, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 2 inches (0 to 6 centimeters); brown (10YR 5/3), broken face, sandy loam, dark brown (10YR 3/3), broken face, moist; 19 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

ABt—2 to 7 inches (6 to 17 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 22 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

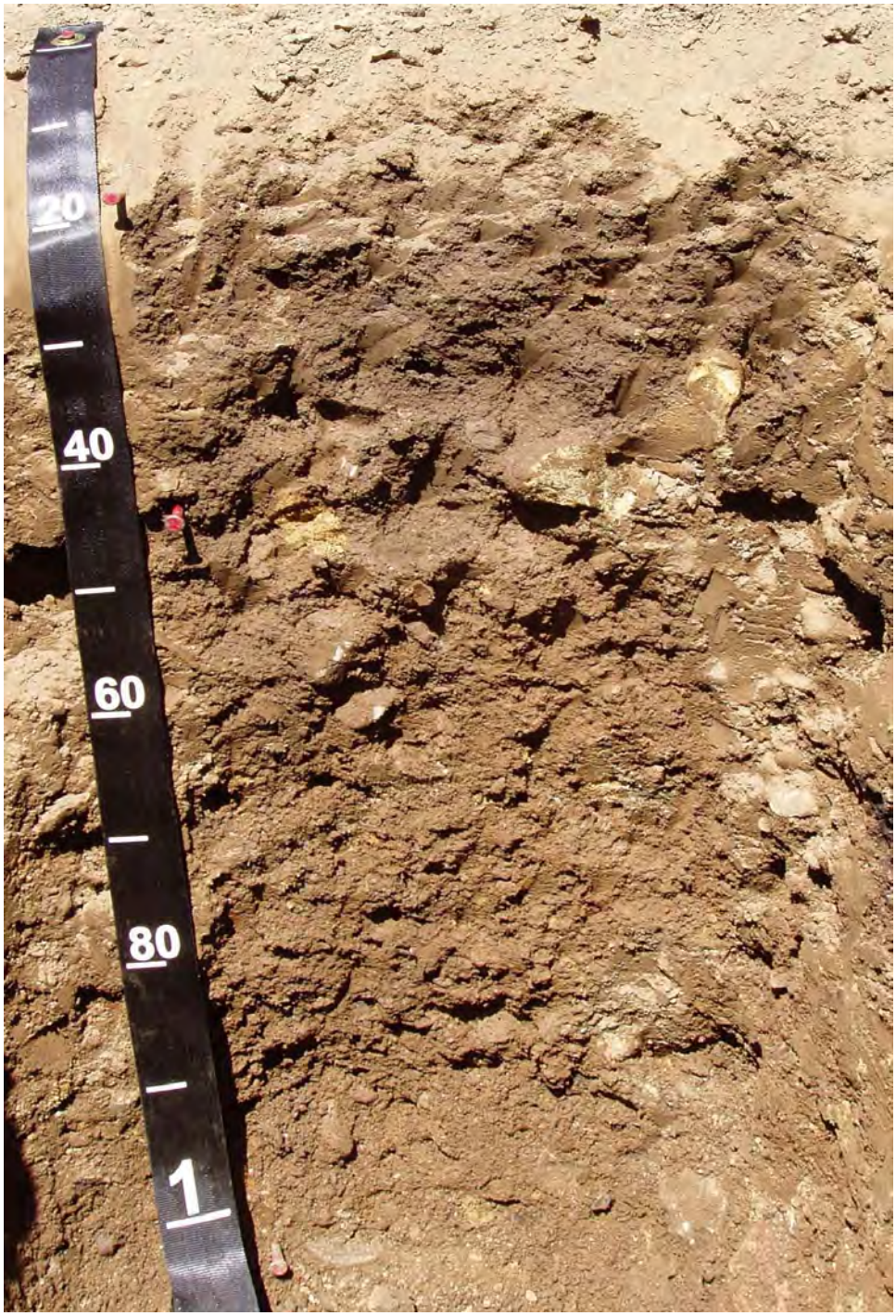


Figure 38.—Representative profile of the Flaskan series. It is in a cultivated area and has loose blocks in the Ap horizon to a depth of 20 centimeters. Scattered gravel occur in the A and Bt horizons to a depth of about 1 meter. There is a slight clay increase from the A horizon to the Bt horizon. The C horizon starts at a depth of about 80 centimeters. This horizon has a high gravel content (50 percent), which is characteristic of Flaskan soils. These soils are productive and well suited to trees; however, digging deep holes in these soils is difficult due to the high gravel content.

Figure 39.—Landscape of Flaskan soils. These soils are extensive on alluvial fans in the survey area. Photo was taken at the Sunnyvale Historical Orchard. Most areas of Flaskan soils have been urbanized for residences.

Bt1—7 to 17 inches (17 to 43 centimeters); brown (10YR 5/3), broken face, gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 25 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent clay films on all faces of peds; 2 percent rounded indurated 75- to 100-millimeter mixed rock fragments and 25 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water; clear smooth boundary.

Bt2—17 to 31 inches (43 to 80 centimeters); yellowish brown (10YR 5/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 22 percent clay; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent clay films on all faces of peds; 2 percent rounded indurated 75- to 100-millimeter mixed rock fragments and 30 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water; clear smooth boundary.

C—31 to 59 inches (80 to 150 centimeters); dark yellowish brown (10YR 4/4), broken face, very gravelly sandy loam, dark yellowish brown (10YR 3/4), broken face, moist; 17 percent clay; strong coarse granular structure; soft, loose, slightly sticky and slightly plastic; many very fine interstitial pores; 50 percent rounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 64 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section averages 18 to 27 percent clay and 15 to 35 percent rock

fragments, mostly gravel. Mineralogy is mixed. Organic matter content ranges from 1 to 3 percent to a depth of 17 centimeters.

The Ap horizon has dry color of 10YR 5/3, 4/3, or 4/2 and moist color of 10YR 3/3 or 3/2. Texture is sandy loam or sandy clay loam or their gravelly equivalents. Clay content ranges from 16 to 27 percent. Rock fragments range from 5 to 30 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The ABt horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 3/3 or 3/2. Texture is sandy clay loam or gravelly sandy clay loam. Clay content ranges from 18 to 27 percent. Rock fragments range from 5 to 30 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The Bt horizon has dry color of 10YR 6/4, 5/4, 5/3, or 4/3 and moist color of 10YR 4/4, 3/4, or 3/3. Texture is gravelly sandy clay loam. Clay content ranges from 18 to 27 percent. Rock fragments range from 15 to 35 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The C horizon has dry color of 10YR 5/4, 4/4, or 4/3 and moist color of 10YR 3/4 or 3/3. Texture is gravelly sandy loam, very gravelly sandy clay loam, or extremely gravelly sandy loam. Clay content ranges from 14 to 27 percent. Rock fragments range from 15 to 75 percent gravel. Reaction ranges from pH 6.1 to 7.3.

Footpath Series

The Footpath series consists of moderately deep and well drained soils that formed in residuum weathered from greenstone (fig. 40). Footpath soils are on hills, mountain slopes, and summits. Slopes range from 8 to 75 percent. The mean annual precipitation is about 1,270 millimeters, and the mean annual air temperature is about 14 degrees C.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Pachic Argixerolls

Typical Pedon

Footpath gravelly coarse sandy loam in an area of Footpath-Mouser complex, 30 to 50 percent slopes; Santa Clara County, California; Almaden Quicksilver County Park, off of Randol Road, about 160 meters northeast of Randol Tunnel, on a north-facing (310 degree) 30 percent slope, in a nonsectionized area of T. 8 S., R. 1 E.; at an elevation of 292 meters; UTM Zone 10, Northing 4116092, Easting 602795, NAD83; USGS quadrangle: Santa Teresa Hills, California. When described on May 5, 2007, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 3 centimeters); very dark gray (10YR 3/1) slightly decomposed plant material consisting of leaves of scrub oak, buckbrush, and sage, black (10YR 2/1) moist; about 100 percent fiber, 80 percent rubbed; loose, nonsticky and nonplastic; moderately acid (pH 5.6); abrupt smooth boundary.

A—1 to 3 inches (3 to 7 centimeters); brown (7.5YR 5/3) gravelly coarse sandy loam, dark brown (7.5YR 3/3) moist; moderate fine subangular blocky structure parting to strong very fine granular; moderately hard, friable, slightly sticky and nonplastic; many very fine to medium roots; many very fine tubular and irregular pores; 30 percent gravel; neutral (pH 6.8); clear smooth boundary.

ABt—3 to 6 inches (7 to 14 centimeters); brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; many very fine to medium roots; many very fine tubular and irregular pores; few faint clay films on all faces of peds; 25 percent gravel; neutral (pH 6.6); clear smooth boundary.

Bt1—6 to 12 inches (14 to 30 centimeters); reddish brown (5YR 5/3) gravelly loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky

Figure 40.—Representative profile of the Footpath series. Photo was taken at Almaden Quicksilver County Park on Randol Road, on a road cut. The A horizon is brown to a depth of about 14 centimeters. The Bt horizon at depth of 14 to 90 centimeters is reddish brown. Rock fragments occur throughout the profile. A fractured stone is visible between depths of 60 and 80 centimeters. The soft paralithic contact of greenstone occurs below a depth of 90 centimeters. Footpath soils are forested with oaks and have extensive areas of poison oak.

structure; hard, firm, moderately sticky and moderately plastic; many very fine to medium roots; many very fine to medium tubular pores; common faint clay films on all faces of peds; 28 percent gravel; neutral (pH 6.6); clear smooth boundary.

Bt2—12 to 35 inches (30 to 90 centimeters); reddish brown (5YR 4/3) extremely paragravelly silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; many fine and medium and common very fine roots; many very fine to medium tubular pores; many faint clay films on all faces of peds; 34 percent gravel; slightly acid (pH 6.5); abrupt wavy boundary.

Cr—35 to 60 inches (90 to 153 centimeters); yellowish brown (10YR 5/4) paralithic greenstone, dark yellowish brown (10YR 4/4) moist; fractures that roots can enter are more than 10 centimeters apart.

Range in Characteristics

Depth to a paralithic contact of sandstone or greenstone is 20 to 40 inches (50 to 100 centimeters). The soils are usually moist in some part of the soil moisture control section between the first of November and the end of April. They are in a xeric moisture regime. The textural control section is the zone between depths of 14 and 64 centimeters. Rock fragments range from 15 to 35 percent and are mostly gravel and cobbles. Pararock fragments range from 15 to 70 percent, are mostly gravel and cobbles, and occur in the lower Bt horizons. These fragments do not occur in all pedons. Clay content averages 20 to 35 percent.

The A horizon has dry color of 10YR 4/3 or 7.5YR 5/3 or 5/2 and moist color of 10YR 3/3, 3/2, or 2.5/2 or 7.5YR 3/3 or 3/2. Texture is gravelly coarse sandy loam, gravelly sandy loam, or gravelly loam. Clay content ranges from 12 to 26 percent. Rock fragments range from 15 to 30 percent and are mostly gravel. Reaction ranges from pH 5.5 to 7.1.

The Bt1 horizon has dry color of 10YR 4/4, 4/3, or 3/3; 7.5YR 5/3 or 4/2; or 5YR 5/6. It has moist color of 10YR 3/4 or 3/3; 7.5YR 3/3, 3/2, or 2.5/2; or 5YR 4/6. Texture is loam, gravelly sandy clay loam, or gravelly loam. Clay content ranges from 25 to 35 percent. Rock fragments range from 15 to 30 percent and are mostly gravel. Reaction ranges from pH 5.6 to 7.1.

The Bt2 horizon has dry color of 10YR 4/3; 7.5YR 4/3; or 5YR 6/2, 4/3, or 4/2. It has moist color of 10YR 3/3; 7.5YR 3/3; or 5YR 4/2, 3/3, or 3/2. Texture is gravelly sandy clay loam or extremely gravelly silty clay loam. Clay content ranges from 25 to 35 percent. Rock fragments range from 15 to 70 percent and are mostly paragravel. Reaction ranges from pH 6.1 to 7.1.

Gaviota Series

The Gaviota series consists of very shallow or shallow, well drained soils that formed in material weathered from hard sandstone or metasandstone. Gaviota soils are on hills and mountains and have slopes of 2 to 100 percent. The average annual precipitation is about 20 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy, mixed, superactive, nonacid, thermic Lithic Xerorthents

Typical Pedon

Gaviota gravelly loam; Stanislaus County, California; 9 miles west of the town of Westley, in grass rangeland, 1,700 feet north and 500 feet east of the southwest

corner of section 6, T. 5 S., R. 6 E., MDB&M; USGS quadrangle: Solyo, California. (Colors are for dry soil unless otherwise noted.)

A1—0 to 6 inches (0 to 15 centimeters); brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

A2—6 to 10 inches (15 to 25 centimeters); brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; neutral (pH 6.8); abrupt wavy boundary.

R—10 to 17 inches (25 to 43 centimeters); pale brown (10YR 6/3) hard metasandstone.

Range in Characteristics

Depth to a lithic contact is 6 to 20 inches. The soils become moist below a depth of 6 inches sometime between mid-October and mid-December and remain moist all the time in some parts below a depth of 6 inches until early April or late May. The mean annual soil temperature is 59 to 64 degrees F, and the soil temperature does not go as low as 41 degrees F at any time. Texture throughout the profile is sandy loam, fine sandy loam, loam, gravelly sandy loam, gravelly fine sandy loam, or gravelly loam. Clay content is 10 to 18 percent. Rock fragment content is less than 25 percent. Sand content is more than 40 percent of the fine-earth fraction. The content of coarse and very coarse sand is less than 20 percent.

The A horizon has color of 10YR 6/2, 6/3, 6/4, 5/2, 5/3, 5/4, 5/6, 5/8, or 4/3; 2.5Y 6/2, 6/4, or 5/2; or 7.5YR 5/2, 5/4, or 6/4. The horizon has moist values of 4 throughout; it may have values of less than 4 only in the upper part or have dry values of 6 or more. Reaction ranges from moderately acid to neutral. Some pedons have a C horizon that differs from the A horizon principally by being one color value unit lighter.

Gilroy Series

The Gilroy series consists of moderately deep, well drained soils that formed in material weathered from basic igneous and metamorphic rocks. Gilroy soils are on uplands and have slopes of 9 to 75 percent. The mean annual precipitation is about 25 inches, and the mean annual air temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, active, thermic Typic Argixerolls

Typical Pedon

Gilroy clay loam; Santa Clara County, California; about 0.4 mile east of the Castro Valley Ranch gate on a hillside northeast of the road, in annual grass rangeland, NE1/4 SW1/4 of section 18, T. 11 S., R. 4 E. (Colors are for dry soil unless otherwise noted.)

A—0 to 8 inches; brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; hard, very friable, sticky and plastic; common very fine roots; many very fine interstitial and common very fine tubular pores; about 5 percent gravel; moderately acid (pH 6.0); clear wavy boundary.

Bt—8 to 21 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; hard, very friable, sticky and plastic; few very fine roots; many very fine interstitial and few fine and medium tubular pores; common thin clay films

on peds and in pores; about 5 percent gravel; moderately acid (pH 6.0); abrupt irregular boundary.

R—21 to 28 inches; brown metamorphosed basic igneous rock (greenstone); somewhat variable as to hardness and composition over short distances; moderately thick clay films on rock surfaces; black manganese stains on mineral grains.

Range in Characteristics

Depth to a lithic contact ranges from 20 to 40 inches. Thickness of the solum also ranges from 20 to 40 inches or is less than depth to bedrock. Rock fragments make up 3 to 30 percent of the soil. The mean annual soil temperature is 59 to 64 degrees F, and the temperature does not go below 41 degrees F. The soil between depths of about 4 and 12 inches is dry by May 15 or June 1 and is continuously dry until late October or early November. Part or all of the soil in this section is moist all the rest of the year. The solum is mainly moderately acid to neutral throughout, tends to become less acid with increasing depth, and is moderately alkaline in some pedons just above the bedrock. Base saturation is more than 75 percent throughout the solum. Organic matter is 2 to 6 percent in the A horizon and decreases regularly to less than 1 percent at a depth of 18 inches. The particle-size control section has less than 30 percent sand.

The A horizon has dry color of 7.5YR 5/4, 5/2, 4/2, or 3/2 or 5YR 5/4, 5/3, or 4/4 and moist color of 7.5YR 3/2 or 5YR 3/2 or 3/3. It is loam or light clay loam and has moderate or strong granular or subangular blocky structure. An AB or BA horizon that is as much as 6 inches thick occurs in some pedons.

The Bt horizon has dry color of 5YR 5/3, 5/4, 4/3, 4/4, 3/2, 3/3, or 3/4 or 7.5YR 5/2, 5/4, 4/2, or 4/4 and moist color of 5YR 4/4, 3/4, or 3/3 or 7.5YR 4/2, 4/4, or 3/2. The lower part of the Bt horizon commonly has lighter colors, and in some pedons the dry value or chroma is 6. The horizon is clay loam with 5 to 8 percent more clay, absolute, than the A horizon and has 27 to 35 percent total clay content. There are few to many thin to thick clay films on peds and in pores. Structure varies from weak to strong angular or subangular blocky.

A BC horizon or C horizon, or both, occur in some pedons.

Hangerone Series

The Hangerone series consists of very deep, poorly drained soils that formed in alluvium from mixed rock sources (fig. 41). Hangerone soils are in basins. Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Cumulic Vertic Endoaquolls

Typical Pedon

Hangerone clay, drained, 0 to 2 percent slopes; Santa Clara County, California; City of Mountain View, Monta Loma Park, west side of the park, west of a path, south of the picnic area, on an east-facing 2 percent slope under a cover of turf grass, in a nonsectionized area of T. 6 S., R. 2 W.; at an elevation of 9 meters; UTM Zone 10, Northing 4140507, Easting 579758, NAD83; USGS quadrangle: Mountain View. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 9 inches (0 to 24 centimeters); dark gray (10YR 4/1), broken face, clay, very dark gray (10YR 3/1), broken face, moist; 35 percent clay; moderate coarse subangular blocky structure; very hard, very firm, moderately sticky and

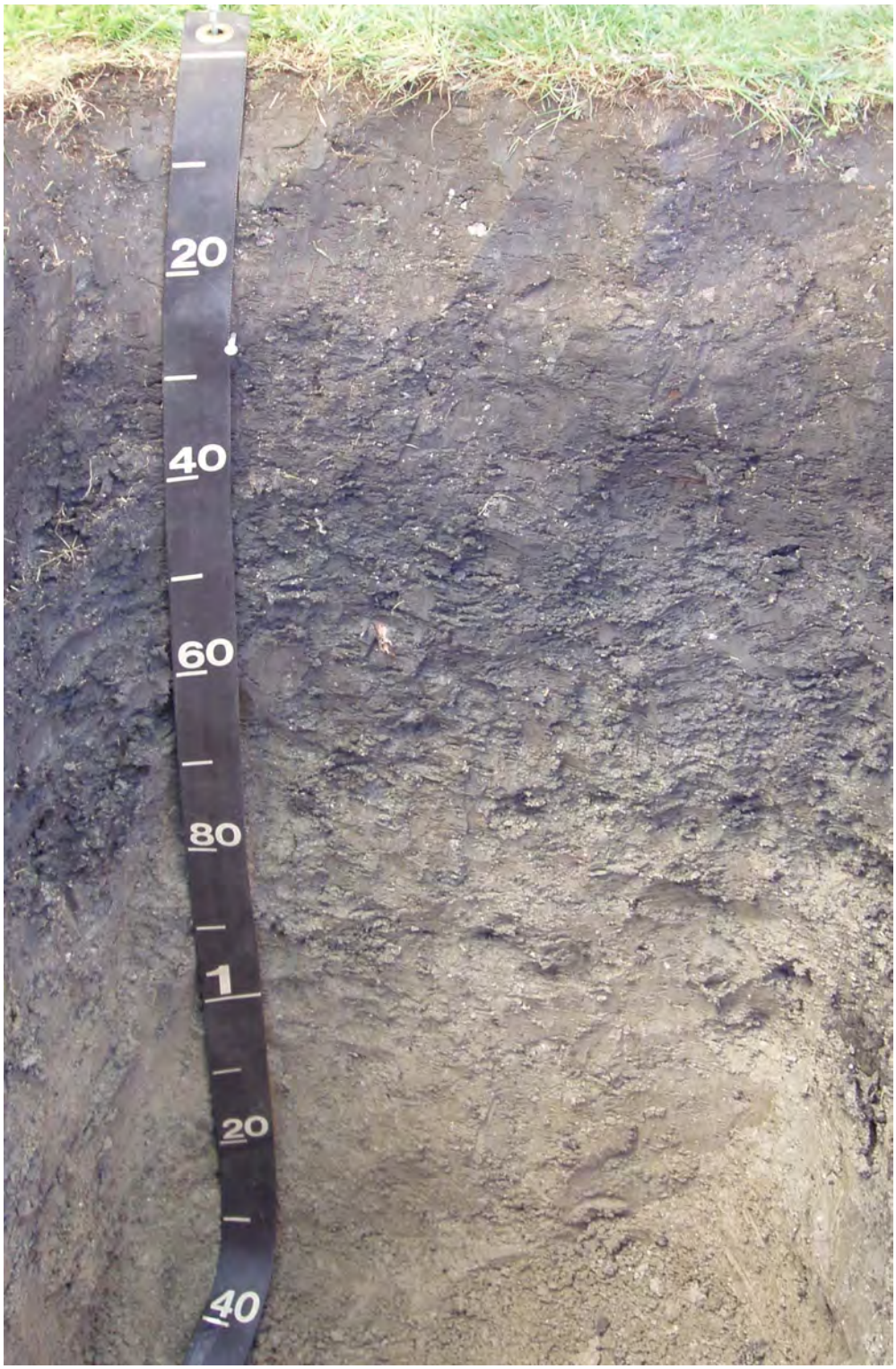


Figure 41.—Representative profile of the Hangerone series. Photo was taken in Monta Loma Park, City of Mountain View. The upper 24 centimeters has been mixed and has white masses of carbonate from C horizon material. Dark gray clay at depths of 24 to 68 centimeters is moist and does not show the cracks that are evident upon drying. Below a depth of 68 centimeters are the light gray Bk, Ck, and C horizons. These horizons are high in carbonates deposited in ground water prior to regional drainage.

moderately plastic; common medium and common very fine roots; common fine irregular pores; 2 percent subrounded strongly cemented 2- to 75-millimeter mixed rock fragments; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1 by pH meter 1:1 water; abrupt smooth boundary. (Upper 1 centimeter of horizon is an Oi layer.)

A2—9 to 17 inches (24 to 42 centimeters); dark gray (10YR 4/1), broken face, clay, very dark gray (10YR 3/1), broken face, moist; 38 percent clay; moderate coarse subangular blocky and moderate medium subangular blocky structure; very hard, very firm, moderately sticky and moderately plastic; common medium and common very fine roots; common fine irregular pores; 1 percent subrounded strongly cemented 2- to 75-millimeter mixed rock fragments; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1 by pH meter 1:1 water; clear smooth boundary.

Bw—17 to 27 inches (42 to 68 centimeters); dark gray (10YR 4/1), broken face, clay, very dark gray (10YR 3/1), broken face, moist; 50 percent clay; moderate coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common medium roots; few fine irregular pores; 65 percent distinct dark gray (10YR 4/1), dry, pressure faces on vertical faces of peds; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3 by pH meter 1:1 water; abrupt wavy boundary.

Bk—27 to 35 inches (68 to 88 centimeters); gray (2.5Y 6/1), broken face, clay, grayish brown (2.5Y 5/2), broken face, moist; 50 percent clay; moderate coarse angular blocky and moderate medium angular blocky structure; hard, firm, very sticky and very plastic; few very fine irregular pores; 20 percent distinct white (10YR 8/1), dry, carbonate coats on all faces of peds and 65 percent distinct gray (2.5Y 6/1), dry, pressure faces on vertical faces of peds; 5 percent fine prominent light brown (7.5YR 6/4), dry, iron-manganese masses in matrix; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4 by pH meter 1:1 water; clear smooth boundary.

Ck—35 to 45 inches (88 to 115 centimeters); light gray (2.5Y 7/1), broken face, clay loam, grayish brown (2.5Y 5/2), broken face, moist; 45 percent clay; moderate coarse angular blocky and moderate medium angular blocky structure; hard, firm, very sticky and very plastic; few very fine irregular pores; 20 percent distinct white (10YR 8/1), dry, carbonate coats on all faces of peds; 5 percent fine prominent light brown (7.5YR 6/4), dry, iron-manganese masses in matrix; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4 by pH meter 1:1 water; abrupt smooth boundary.

C—45 to 72 inches (115 to 183 centimeters); light gray (2.5Y 7/2), broken face, gravelly loam, grayish brown (2.5Y 5/2), broken face, moist; 9 percent clay; weak coarse granular and weak medium granular structure; moderately hard, friable, nonsticky and nonplastic; many very fine irregular pores; 30 percent subrounded strongly cemented 2- to 75-millimeter mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5 by pH meter 1:1 water; abrupt smooth boundary.

2Ab—72 to 89 inches (183 to 225 centimeters); dark gray (2.5Y 4/1), broken face, clay, black (2.5Y 2.5/1), broken face, moist; 24 percent clay; moderate coarse subangular blocky structure; hard, firm, moderately sticky and moderately plastic; common very fine irregular pores; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1 by pH meter 1:1 water.

Range in Characteristics

Depth to the calcic horizon is 60 to 100 centimeters. These soils have been drained by historic overdrafting of ground water in the Santa Clara Valley, and flooding has been controlled by dams and channelization of streams. The mean annual soil

temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section averages 35 to 60 percent clay. Mineralogy is smectitic. The soils are calcareous throughout and have slight to violent effervescence. Organic matter content ranges from 1 to 4 percent to a depth of 24 centimeters. Surface-initiated reversible cracks 1 to 4 centimeters wide extend to a depth of 25 centimeters from June to October when the soils are not irrigated. Slickensides are not evident in the soil profile but pressure faces occur below the A horizon and in the upper calcic horizon. A fluctuating apparent water table may occur in a few areas at a depth of 120 to 160 centimeters from December through April.

The A horizon has dry color of 10YR 4/1, 3/1, 2/2, or 2/1 or 2.5Y 2.5/1 and moist color of 10YR 2/2 or 2/1 or 2.5Y 3/1 or 2.5/1. Texture is clay loam, silty clay loam, or clay. Clay content ranges from 27 to 40 percent. Rock fragments range from 0 to 5 percent rounded gravel. Reaction ranges from pH 7.3 to 8.4.

The Bw horizon has dry color of 10YR 4/1 or 3/1 or 2.5Y 4/1 and moist color of 10YR 3/1 or 2/1 or 2.5Y 3/1 or 2.5/1. Texture is clay loam, silty clay loam, silty clay, or clay. Clay content ranges from 35 to 55 percent. Rock fragments range from 0 to 10 percent rounded gravel. Reaction ranges from pH 7.3 to 8.4.

The Bk horizon has dry color of 10YR 5/1, 4/1, or 3/1 or 2.5Y 8/1, 7/2, 7/1, 6/1, or 4/1 and moist color of 10YR 4/1, 3/1, or 2/1 or 2.5Y 7/2, 5/3, 5/2, or 2.5/1. Texture is clay loam, silty clay, or clay. Clay content ranges from 35 to 55 percent. Carbonate content ranges from 10 to 25 percent. Rock fragments range from 0 to 10 percent rounded gravel. Reaction ranges from pH 7.3 to 8.4.

The Ck horizon has dry color of 10YR 7/3, 7/1, 6/3, 6/1, or 5/1 or 2.5 7/3, 7/1, or 5/3 and moist color of 10YR 5/2 or 4/1 or 2.5Y 5/3, 5/2, or 5/1. Texture is sandy clay loam, clay loam, silty clay, or clay. Clay content ranges from 35 to 45 percent. Carbonate content ranges from 10 to 25 percent. Rock fragments range from 0 to 10 percent rounded gravel. Reaction ranges from pH 7.8 to 8.4.

The C and 2Ab horizons (if they occur) have dry color of 10YR 7/3 or 2.5Y 7/3 or 7/1 and moist color of 2.5Y 5/4, 5/3, or 5/2. Texture is gravelly loam, silt loam, silty clay loam, sandy clay loam, or clay. Clay content ranges from 9 to 40 percent. Rock fragments range from 0 to 35 percent rounded gravel. Reaction ranges from pH 7.8 to 8.6.

Haploxerolls, Limestone

Haploxerolls, limestone consist of well drained soils that formed from limestone parent materials. These soils are on mountains and hillsides. Slopes range from 8 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees C.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Pachic Haploxerolls

Typical Pedon

Haploxerolls, limestone; Santa Clara County, California; southwest of the radio towers near limestone outcrops on Black Mountain, Monte Bello Open Space, on a northwest-facing 20 percent slope, in section 13, T. 7 S., R. 3 W.; at an elevation of 2,790 feet; lat. 37 degrees 19 minutes 2 seconds N. and long. 122 degrees 8 minutes 53 seconds W., NAD83; USGS quadrangle: Mindego Hill, California. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Haploxerolls in this survey area because of the highly variable nature of these soils.

A1—0 to 3 inches (0 to 7 centimeters); brown (10YR 4/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 10 percent clay; weak

fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; 10 percent subangular strongly cemented 75- to 250-millimeter limestone fragments and 40 percent subangular strongly cemented 2- to 75-millimeter limestone fragments; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt wavy boundary.

A2—3 to 11 inches (7 to 29 centimeters); brown (10YR 4/3), broken face, gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 10 percent clay; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 20 percent subangular strongly cemented 75- to 250-millimeter limestone fragments and 30 percent subangular strongly cemented 2- to 75-millimeter limestone fragments; strong effervescence; neutral, pH 7.3 by pH meter 1:1 water; abrupt wavy boundary.

AC—11 to 23 inches (29 to 58 centimeters); brown (7.5YR 4/3), broken face, very cobbly sandy loam, dark brown (7.5YR 3/3), broken face, moist; 10 percent clay; massive; soft, very friable, slightly sticky and nonplastic; common very fine roots; many very fine irregular pores; 30 percent subangular strongly cemented 2- to 75-millimeter limestone fragments and 40 percent subangular strongly cemented 75- to 250-millimeter limestone fragments; strong effervescence; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt wavy boundary.

R—23 to 24 inches (58 to 61 centimeters); strongly cemented, highly fractured limestone; about 5 percent soil material in fractures.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is 20 to 40 inches. The mean annual soil temperature is 55 to 59 degrees F. The particle-size control section averages 8 to 15 percent clay and 40 to 55 percent rock fragments.

The A horizon has dry color of 10YR 4/3 and moist color of 10YR 3/3. Texture is gravelly or very gravelly sandy loam. Clay content ranges from 8 to 15 percent. Rock fragments range from 20 to 50 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 6.6 to 7.3.

The AC horizon has color (both dry and moist) of 10YR 4/3. Texture is very cobbly or very gravelly sandy loam. Clay content ranges from 8 to 15 percent. Rock fragments range from 30 to 70 percent and are 2 to 75 millimeters and 75 to 250 millimeters in size.

Hecker Series

The Hecker series consists of deep, well drained soils that formed in material weathered from shale and sandstone. Hecker soils are on uplands and have slopes of 30 to 75 percent. The mean annual precipitation is about 48 inches, and the mean annual air temperature is about 55 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Mollic Haploxeralfs

Typical Pedon

Hecker gravelly sandy loam; Santa Cruz, California; about 1.8 miles east-southeast from the intersection of Mt. Bache Road and Highland Way, about 200 feet below Highland Way on an east turn, under brush and conifer cover, in the SE1/4 NE1/4 of section 5 (projected); lat. 37 degrees 5 minutes 44 seconds N. and long. 121 degrees 52 minutes 53 seconds W., NAD83; USGS quadrangle: Laurel, California. (Colors are for dry soil unless otherwise noted.)

A1—0 to 4 inches (0 to 10 centimeters); brown (7.5YR 5/2) gravelly sandy loam, dark brown (7.5YR 3/2) moist; moderate very coarse angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common medium, fine, and very fine tubular and common very fine and fine interstitial pores; 25 percent gravel, 2 percent cobbles, and 1 percent stones; neutral (pH 6.6); abrupt wavy boundary.

A2—4 to 9 inches (10 to 23 centimeters); pinkish gray (7.5YR 6/2) and brown (10YR 5/3) rubbed, gravelly loam, dark brown (7.5YR 3/2 or 4/4) moist; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common medium and fine tubular and common fine and very fine interstitial pores; 25 percent gravel, 2 percent cobbles, and 1 percent stones; moderately acid (pH 6.0); clear wavy boundary.

Bt1—9 to 16 inches (23 to 41 centimeters); variegated pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (7.5YR 4/4) and strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; many coarse and medium and common fine interstitial pores; 35 percent gravel, 2 percent cobbles, and 1 percent stones, by volume; few thin clay films lining pores and common thin clay films as bridges between mineral grains; moderately acid (pH 6.0); gradual wavy boundary.

Bt2—16 to 23 inches (41 to 58 centimeters); light brown (7.5YR 6/4) and pink (7.5YR 7/4) gravelly sandy loam, strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; many coarse and medium and common fine and very fine roots; many very fine interstitial and many very fine and fine tubular pores; common thin clay films as bridges between mineral grains and lining pores; 30 percent gravel, 2 percent cobbles, and 1 percent stones; moderately acid (pH 6.0); gradual wavy boundary.

Bt3—23 to 31 inches (58 to 79 centimeters); light brown (7.5YR 6/4) and pink (7.5YR 7/4) very gravelly loam, strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; many coarse and medium and common fine and very fine roots; many very fine interstitial and many very fine and fine tubular pores; 70 percent gravel and 2 percent cobbles and stones; common thin clay films as bridges between mineral grains and lining pores; moderately acid (pH 6.0); gradual wavy boundary.

Bt4—31 to 41 inches (79 to 104 centimeters); light brown (7.5YR 6/4) and pink (7.5YR 7/4) very gravelly clay loam, brown (7.5YR 4/4) and strong brown (7.5YR 5/6), rubbed, moist; moderate medium subangular blocky structure, crushing to fine granules before powdering; hard, friable, sticky and plastic; few fine and very fine and common medium roots; common very fine tubular and few very fine interstitial pores; 70 percent gravel, 5 percent cobbles, and 5 percent stones; many thin clay films as bridges between mineral grains and lining pores; moderately acid (pH 6.0); gradual wavy boundary.

Cr—41 to 58 inches (104 to 147 centimeters); shattered shale.

Range in Characteristic

Depth to a paralithic contact is 40 to 60 inches. The soil between depths of 10 to 40 inches becomes moist in some part in October or early November and remains moist until June or July. The mean annual soil temperature is about 57 degrees F. These soils contain up to 80 percent, by volume, stones, cobbles, and gravel. Reaction ranges from neutral to moderately acid throughout the profile. Base saturation is 75 to 95 percent throughout the solum.

The A horizon has color of 7.5YR 6/2, 6/4, 5/4, or 5/2 or 10YR 6/2, 6/3, 6/4, 5/2, 5/3, or 5/4. Texture is gravelly sandy loam or gravelly loam. The horizon has 20 to 40 percent, by volume, gravel and up to 10 percent cobbles and stones combined.

The upper part of the Bt horizon has color of 10YR 5/3, 6/3, or 6/4; 7.5YR 7/4, 6/2, 6/4, 5/4, or 5/2; or 5YR 6/3, 6/4, 5/4, or 5/3. Texture is very gravelly or gravelly sandy loam, loam, or clay loam. This part has 30 to 50 percent, by volume, gravel and up to 10 percent cobbles and stones combined.

The lower part of the Bt horizon has color of 10YR 6/3 or 6/4; 7.5YR 7/4 or 6/4; or 5YR 6/3, 6/4, 5/3, or 5/4. Texture is gravelly, very gravelly, cobbly, very cobbly, or stony loam, sandy clay loam, or clay loam. Rock fragments average about 40 to 80 percent, by volume.

Hillgate Series

The Hillgate series consists of very deep, well drained and moderately well drained soils that formed in alluvium from mixed sources. Hillgate soils are on low terraces with slopes of 0 to 50 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 61 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Typic Palexeralfs

Typical Pedon

Hillgate loam; Colusa County, California; about 4.5 miles west of Maxwell, on an east-facing slope of 3 percent, in rangeland, 2,400 feet south and 2,500 feet east of the northwest corner of section 2, T. 16 N., R. 4 W., MDB&M; at an elevation of 140 feet; lat. 39 degrees 16 minutes 10 seconds N. and long. 121 degrees 16 minutes 20 seconds W.; USGS quadrangle: Sites, California. (Colors are for dry soil unless otherwise noted.)

A1—0 to 3 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; few fine distinct light brownish gray (10YR 6/2) iron depletions; slightly acid (pH 6.2); abrupt smooth boundary.

A2—3 to 11 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; strong medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine and few fine tubular pores; common fine distinct light brownish gray (10YR 6/2) iron depletions; moderately acid (pH 5.6); clear smooth boundary.

A3—11 to 19 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; strong medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine and few fine tubular pores; common fine faint very pale brown (10YR 7/3) iron depletions; moderately acid (pH 5.6); abrupt smooth boundary.

2Bt1—19 to 38 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 3/4) moist; strong coarse prismatic structure; extremely hard, firm, moderately sticky and moderately plastic; few very fine roots; common very fine and few fine tubular pores; many moderately thick clay films; slightly acid (pH 6.2); clear smooth boundary.

2Bt2—38 to 53 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; strong coarse prismatic structure; extremely hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many moderately thick clay films; neutral (pH 7.2); clear smooth boundary.

2Bt3—53 to 63 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many moderately thick clay films; slightly alkaline (pH 7.5); clear smooth boundary.

2Bt4—63 to 73 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many moderately thick clay films; slightly alkaline (pH 7.4).

Range in Characteristics

The mean annual soil temperature is 63 to 65 degrees F, and the soil temperature does not drop below 47 degrees F at any time. Between depths of 6 and 18 inches, these soils are dry in all parts from May 15 to October 31 and moist in some or all parts from November 1 to May 15. The weighted average clay content for the 19- to 39-inch textural control section ranges from 35 to 50 percent. The solum ranges from 60 to 75 inches in thickness.

The A horizon has dry color of 10YR 7/2, 6/4, 6/3, 6/2, 5/4, or 5/3 or 7.5YR 5/4 or 4/4 and moist color of 10YR 5/3, 4/4, 4/3, 3/4, or 3/3 or 7.5YR 4/4 or 3/4. Texture is very fine sandy loam, loam, silt loam, or clay loam. Reaction ranges from strongly acid to slightly acid.

The Bt horizon has dry color of 10YR 6/6, 6/3, 5/8, 5/6, 5/4, or 5/3 or 7.5YR 5/8, 5/6, 5/5, 5/4, or 4/6 and moist color of 10YR 5/6, 5/4, 4/6, 4/4, 4/3, 3/4, or 3/3 or 7.5YR 5/4, 5/6, 4/6, 4/4, 4/3, or 3/4. Texture is clay loam or clay. Reaction ranges from slightly acid to moderately alkaline.

Katykat Series

The Katykat series consists of deep and very deep, well drained soils that formed in residuum weathered from sandstone, mudstone, and greenstone (fig. 42). Katykat soils are on hills, mountain slopes, and summits (fig. 43). Slopes range from 8 to 75 percent. The mean annual precipitation is about 1,270 millimeters, and the mean annual air temperature is about 14 degrees C.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Ultic Haploxeralfs

Typical Pedon

Katykat loam in an area of Kaykat-Sanikara complex, 8 to 30 percent slopes; Santa Clara County, California; Sierra Azul Open Space, on Priest Rock Trail, 230 meters east of its intersection with Limekiln Trail, on a north-facing (340 degree) 10 percent slope, in a nonsectionized area of T. 8 S., R. 1 W.; at an elevation of 537 meters; UTM Zone 10, 4116092 Northing, 602795 Easting, NAD83; USGS quadrangle: Los Gatos, California. When described on October 31, 2006, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 3 centimeters); very dark gray (10YR 3/1) slightly decomposed plant material consisting of leaves and twigs of scrub oak and chamise needles, black (10YR 2/1) moist; about 100 percent fiber, 80 percent rubbed; loose, nonsticky and nonplastic; moderately acid (pH 5.6); abrupt smooth boundary. (0 to 10 centimeters thick)

A1—1 to 4 inches (3 to 10 centimeters); brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) moist; 20 percent clay; weak very fine subangular blocky structure parting to strong very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, many fine, and common medium roots; many very fine and common medium tubular pores; 10 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—4 to 8 inches (10 to 20 centimeters); light brown (7.5YR 5/4) loam, brown (7.5YR 3/4) moist; 22 percent clay; weak very fine subangular blocky structure parting to strong very fine granular; slightly hard, friable, slightly sticky and slightly plastic;

Figure 42.—Representative profile of the Katykat series. These soils occur in stable slope and summit positions. The A horizon extends to a depth of about 20 centimeters. The reddish yellow argillic horizon below has an increase of about 10 percent more clay than the A horizon. The argillic or Bt horizon continues deep in the profile before transitioning to a BCt horizon, which has a high content of paragravelly or highly weathered fragments.

Figure 43.—Landscape of Katykat soils. Photo was taken on Priest Rock Trail in the Sierra Azule Open Space. Oaks, brush, and poison oak are the dominant vegetation.

common very fine to medium roots; many very fine to medium tubular pores; 15 percent gravel; neutral (pH 6.7); clear smooth boundary. (Combined thickness of A horizons is 15 to 25 centimeters.)

Bt1—8 to 14 inches (20 to 35 centimeters); reddish yellow (7.5YR 6/4) gravelly clay loam, strong brown (7.5YR 4/4) moist; 32 percent clay; moderate fine and medium subangular blocky structure; moderately hard, firm, moderately sticky and moderately plastic; many medium and common fine and very fine roots; many very fine to many medium tubular pores; many discontinuous faint clay films on all faces of peds; 20 percent paragravel; moderately acid (pH 6.0); clear smooth boundary.

Bt2—14 to 22 inches (35 to 55 centimeters); reddish yellow (7.5YR 6/6) gravelly clay loam, strong brown (7.5YR 4/6) moist; 30 percent clay; moderate medium and moderate fine subangular blocky structure; moderately hard, firm, moderately sticky and moderately plastic; many fine and many medium roots; many very fine to medium tubular pores; common distinct clay films on all faces of peds; 25 percent paragravel; slightly acid (pH 6.2); clear smooth boundary.

Bt3—22 to 34 inches (55 to 85 centimeters); strong brown (5YR 5/6) paragravelly clay loam, strong brown (5YR 4/6) moist; 34 percent clay; moderate medium and moderate fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; many fine and many medium roots; many very fine to medium tubular pores; many distinct clay films on all faces of peds; 30 percent paragravel; moderately acid (pH 5.8); clear smooth boundary.

Bt4—34 to 50 inches (85 to 128 centimeters); reddish yellow (5YR 5/6) very paragravelly clay loam, strong brown (5YR 4/6) moist; 32 percent clay; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky and

very plastic; many fine and medium roots; many very fine to medium tubular pores; many distinct clay films on all faces of peds; 45 percent paragravel; moderately acid (pH 5.9); clear smooth boundary. (Combined thickness of Bt horizons is 60 to 110 centimeters.)

BCt1—50 to 60 inches (128 to 152 centimeters); reddish yellow (5YR 6/6) extremely paragravelly loam, strong brown (7.5YR 4/6) moist; 27 percent clay; massive; moderately hard, friable, moderately sticky and moderately plastic; common faint clay films on all faces of peds; 70 percent paragravel; moderately acid (pH 5.7); gradual wavy boundary.

BCt2—60 to 71 inches (152 to 180 centimeters); reddish yellow (7.5YR 6/6) extremely paragravelly loam, strong brown (7.5YR 5/6) moist; 26 percent clay; massive; moderately hard, friable, moderately sticky and moderately plastic; few faint clay films on all faces of peds; 70 percent paragravel; moderately acid (pH 5.7).

Range in Characteristics

Depth to a paralithic contact is 100 centimeters to more than 150 centimeters. The mean annual soil temperature is about 56 to 60 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section is 20 to 70 centimeters thick and averages 23 to 35 percent clay and 10 to 35 percent rock fragments (mostly gravel and paragravel in the lower part). Paragravel slake in water. Mineralogy is mixed. Organic matter content ranges from 2 to 6 percent to a depth of 20 centimeters.

The A horizon has dry color of 10YR 6/4, 6/3, 5/6, 5/4, or 4/4 or 7.5YR 6/6, 6/4, 5/4, 4/6, or 4/3 and moist color of 10YR 5/3, 4/4, 4/3, or 3/4 or 7.5YR 4/6, 4/4, or 3/4. Texture is loam, sandy loam, sandy clay loam, gravelly loam, or gravelly sandy loam. Clay content ranges from 16 to 22 percent. Rock fragments range from 10 to 30 percent. Reaction ranges from pH 5.0 to 6.8.

The Bt1 and Bt2 horizons have dry color of 10YR 6/4, 5/6, 5/4, or 4/4; 7.5YR 6/6, 6/3, 5/6, 5/4, 4/6, or 4/4; or 5YR 5/6, 5/4, or 4/4. They have moist color of 10YR 4/6, 4/4, 4/3, or 3/4; 7.5YR 5/6, 4/6, 4/4, or 3/4; or 5YR 4/6, 4/4, or 3/4. Texture is gravelly loam, gravelly sandy clay loam, or gravelly clay loam. Clay content ranges from 23 to 35 percent. Rock fragments range from 0 to 35 percent and are mostly gravel. Reaction ranges from pH 4.8 to 6.6.

The Bt3 and Bt4 horizons have dry color of 10YR 6/4, 5/6, 5/4, or 4/4; 7.5YR 6/6, 6/3, 5/6, 5/4, 4/6, or 4/4; or 5YR 5/6, 5/4, or 4/4. They have moist color of 10YR 4/6, 4/4, 4/3, or 3/4; 7.5YR 5/6, 4/6, 4/4, or 3/4; or 5YR 4/6, 4/4, or 3/4. Texture is very paragravelly clay loam, paragravelly loam, paragravelly sandy clay loam, or paragravelly clay loam. Clay content ranges from 23 to 35 percent. Rock fragments range from 15 to 45 percent and are mostly paragravel. Reaction ranges from pH 4.8 to 6.6

The BCt horizon has dry color of 10YR 6/4, 6/3, or 5/4; 7.5YR 6/6, 5/6, or 5/4; or 5YR 5/6. It has moist color of 10YR 4/4; 7.5YR 5/6, 4/6, 4/4, or 3/4; or 5YR 4/6. Texture is extremely paragravelly loam, very paragravelly sandy clay loam, or very paragravelly clay loam. Clay content ranges from 23 to 35 percent. Rock fragments range from 35 to 70 percent and are mostly paragravel. Reaction ranges from pH 5.2 to 6.6.

Kawenga Series

The Kawenga series consists of deep, well drained soils that formed in residuum from sandstone (fig. 44). Kawenga soils are on mountains (fig. 45). Slopes range from 15 to 40 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 59 degrees F.

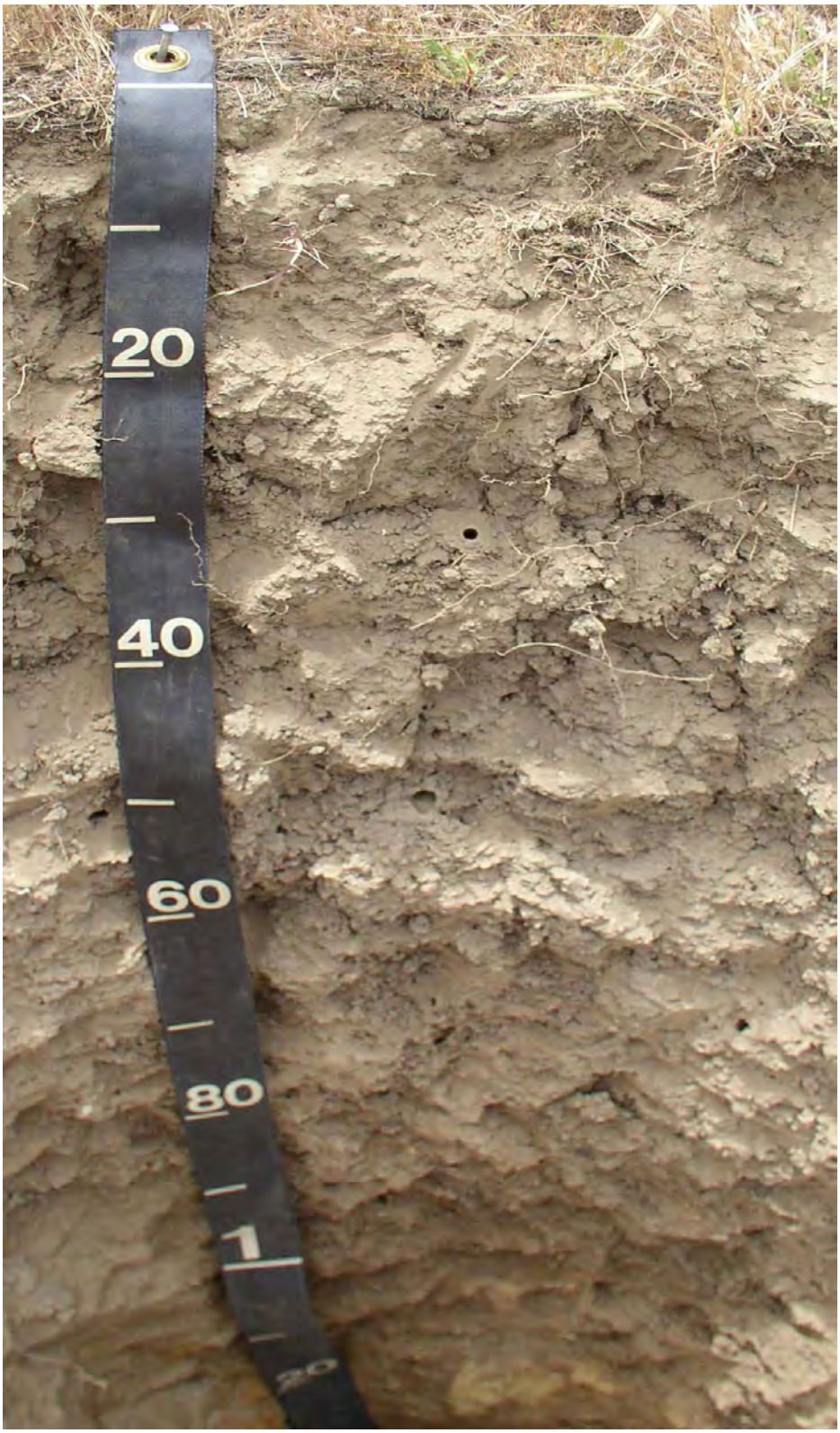


Figure 44.—Representative profile of the Kawenga series. The brown A horizon is porous with visible large soil pores. The brown argillic horizon, below a depth of 58 centimeters, has a small increase in clay content and is also porous. The paralithic contact, at a depth of 129 centimeters, is weathered sandstone.

Figure 45.—Landscape of Kawenga and Lodo soils. Photo was taken near Monument Peak, east of Milpitas. Kawenga soils occur on the lower slopes, and Lodo soils occur on the steep slopes. Sharply tilted outcrops of sandstone occur across some of the ridges.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Kawenga fine sandy loam in an area of Kawenga-Lodo complex, 15 to 30 percent slopes; Santa Clara County, California; Ed Levin County Park, Milpitas, Monument Peak, in a road cut near a wind sock and radio facility, on a northeast-facing 23 percent slope under a cover of annual grasses and forbs, in section 21, T. 5 S., R. 1 W.; at an elevation of 692 meters; UTM Zone 10, Northing 4148321, Easting 600720, NAD83; USGS quadrangle: Calaveras Reservoir, California. When described, the soil was dry to a depth of 58 centimeters and moist below. (Colors are for dry soil unless otherwise noted.)

A1—0 to 5 inches (0 to 12 centimeters); brown (10YR 5/3), broken face, fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 18 percent clay; strong medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent subangular moderately cemented 2- to 75-millimeter sandstone fragments; moderately acid, pH 6.1 by pH meter 1:1 water; clear smooth boundary.

A2—5 to 11 inches (12 to 29 centimeters); brown (10YR 5/3), broken face, sandy clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 22 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common medium and

many very fine tubular pores; 5 percent subangular moderately cemented 2- to 75-millimeter sandstone fragments; moderately acid, pH 6.0 by pH meter 1:1 water; clear smooth boundary.

ABt—11 to 23 inches (29 to 58 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common coarse and many very fine tubular pores; 5 percent clay films on all faces of peds; 5 percent subangular moderately cemented 2- to 75-millimeter sandstone fragments; moderately acid, pH 5.9 by pH meter 1:1 water; clear smooth boundary.

Bt1—23 to 35 inches (58 to 88 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 24 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; common coarse and many very fine tubular pores; 50 percent clay films on all faces of peds; 5 percent subangular moderately cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.2 by pH meter 1:1 water; clear smooth boundary.

Bt2—35 to 43 inches (88 to 110 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 26 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; common coarse and many very fine tubular pores; 70 percent clay films on all faces of peds; 5 percent subangular moderately cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt smooth boundary.

Bt3—43 to 51 inches (110 to 129 centimeters); brown (10YR 5/3), broken face, very cobbly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 26 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common coarse and many very fine tubular pores; 70 percent clay films on all faces of peds; 5 percent subangular moderately cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.3 by pH meter 1:1 water; abrupt wavy boundary.

Cr—51 to 52 inches (129 to 131 centimeters); moderately cemented sandstone.

Range in Characteristics

Depth to weathered sandstone is 100 to 150 centimeters. The mean annual soil temperature is 59 to 62 degrees F. The soil moisture control section is dry in all parts from about May 15 to October 15 (about 150 days). The particle-size control section averages 20 to 27 percent clay and 1 to 15 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous, although in some pedons the lower part may contain some free carbonates and the bedrock may be calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 40 centimeters. Rock fragments on the surface range from 0 to 5 percent stones.

The A and AB horizons have dry color of 10YR 5/3, 4/3, or 4/2 and moist color of 10YR 3/2 or 2/2. Texture is fine sandy loam, sandy clay loam, or very fine sandy loam. Clay content ranges from 12 to 23 percent. Rock fragments range from 1 to 5 percent gravel. Reaction ranges from pH 5.1 to 6.1.

The Bt horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 3/4 or 3/3. Texture is fine sandy loam or sandy clay loam. Clay content ranges from 19 to 30 percent. Rock fragments consisting of gravel range from 1 to 15 percent and, in the lower part just above the Cr horizon, up to 40 percent.

The Cr horizon is weathered fined grained sandstone.

Landelspark Series

The Landelspark series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 46). Landelspark soils are on flood plains. Slopes range from 0 to 2 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Fluventic Haploxerolls

Typical Pedon

Landelspark sandy loam in an area of Urban land-Landelspark complex, 0 to 2 percent slopes; Santa Clara County, California; Landel Park, City of Mountain View, in an area covered with shredded bark south of the playing field, midway between the playing field and sidewalk, on a southwest-facing 2 percent slope under a cover of scattered shrubs and trees, in a nonsectionized area of T. 6 S., R. 2 W.; at an elevation of 76 meters; UTM Zone 10, Northing 4138243, Easting 0582350, NAD83; USGS quadrangle: Mountain View, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 3 centimeters); slightly decomposed plant material; abrupt smooth boundary.

A1—1 to 4 inches (3 to 10 centimeters); brown (10YR 5/3), broken face, sandy loam, dark brown (10YR 3/3), broken face, moist; 18 percent clay; moderate coarse and moderate very coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 5 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 7.2 by pH meter 1:1 water; abrupt smooth boundary.

A2—4 to 10 inches (10 to 26 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 22 percent clay; moderate very coarse and moderate coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 10 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 7.1 by pH meter 1:1 water; abrupt wavy boundary.

A3—10 to 19 inches (26 to 48 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; moderate medium and moderate coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 10 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

C—19 to 23 inches (48 to 59 centimeters); pale brown (10YR 6/3), broken face, very gravelly sand, dark grayish brown (10YR 4/2), broken face, moist; 2 percent clay; single grain; loose, loose, nonsticky and nonplastic; many very fine interstitial pores; 50 percent well rounded indurated 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

Ab1—23 to 35 inches (59 to 90 centimeters); brown (10YR 4/3), broken face, silty clay loam, very dark brown (10YR 2/2), broken face, moist; 27 percent clay; moderate coarse and moderate very coarse subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common very fine tubular pores; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear smooth boundary.

Ab2—35 to 55 inches (90 to 140 centimeters); brown (10YR 4/3), broken face, clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 29 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky

Figure 46.—Representative profile of the Landelspark series. It is located in Landel Park, in the City of Mountain View, close to Stevens Creek. The surface is covered with shredded bark. The brown A horizon of sandy clay loam extends to a depth of 48 centimeters and ends abruptly. A C horizon of very gravelly sand occurs from a depth of 48 to 59 centimeters; the gravel are well rounded and were probably deposited during a major flooding event. Below a depth of 59 centimeters is a buried A horizon of silty clay loam or sandy clay loam. Landelspark soils occur near stream channels and may or may not have a C horizon but always have a buried A horizon.

and moderately plastic; common coarse roots; common very fine tubular pores; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

AB—55 to 79 inches (140 to 200 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 25 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common very fine tubular pores; slightly alkaline, pH 7.4 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 1 (about 120 days). The particle-size control section averages 18 to 27 percent clay and 0 to 20 percent rock fragments, mostly gravel. Depth to a buried soil is 40 to 120 centimeters; the buried soil may not occur within 150 centimeters in some pedons. Mineralogy is mixed. The soils are noncalcareous in most pedons. Organic matter content ranges from 2 to 4 percent to a depth of 26 centimeters. Flooding has been controlled in most areas by a combination of levees, channelization of streams, upstream flood-control dams, and historic ground-water pumping.

The A horizon has dry color of 10YR 4/2, 4/3, 5/2, or 5/3 or 2.5Y 4/2 or 5/3 and moist color of 10YR 2/2, 3/2, or 3/3 or 2.5Y 3/2. Texture is sandy loam, sandy clay loam, fine sandy loam, or loam or their gravelly analogs. Clay content ranges from 15 to 25 percent. Rock fragments range from 0 to 20 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 6.1 to 7.8.

The C horizon has dry color of 10YR 4/2, 5/2, 5/4, or 6/3 or 2.5Y 4/2 and moist color of 10YR 3/3, 4/2, or 4/3 or 2.5Y 3/2. Texture is very gravelly sand, very gravelly loamy sand, or very gravelly sandy loam. Clay content ranges from 2 to 10 percent. Rock fragments range from 40 to 55 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 6.6 to 7.8.

The Ab horizon has dry color of 10YR 4/3 or 2.5Y 4/2, 5/2, or 5/3 and moist color of 10YR 2/2, 3/2, or 3/3 or 2.5Y 3/2 or 3/3. Texture is silty clay loam, clay loam, or sandy clay loam. Clay content ranges from 25 to 30 percent. Rock fragments range from 0 to 20 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 7.4 to 7.8.

The AB horizon has dry color of 10YR 4/3 or 5/3 or 2.5Y 5/2 or 5/3 and moist color of 10YR 2/2, 3/2, or 3/3 or 2.5Y 3/2 or 3/3. Texture is sandy loam or sandy clay loam. Clay content ranges from 10 to 25 percent. Rock fragments range from 0 to 20 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 7.4 to 7.8.

Literr Series

The Literr series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 47). Literr soils are on terraces (fig. 48). Slopes range from 15 to 65 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Literr loam, 15 to 30 percent slopes; Santa Clara County, California; Fremont Older Open Space, Cupertino, about 0.25 mile from Gate FO02, up the ridge past Seven Springs Trail, on a north-facing 25 percent slope under a cover of annual grasses, about 75 feet below the road, in section 26, T. 7 S., R. 2 W.; at an elevation of

Figure 47.—Representative profile of the Literr series. The brown A horizon extends to a depth of 34 centimeters and grades into the Bt horizon with a clay content between 35 and 45 percent. The profile has scattered rounded gravel; gravel content increases in strata below the depth visible in the photo.

247 meters; UTM Zone 10, Northing 4127398, Easting 583397, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 2 centimeters); slightly decomposed plant material; abrupt smooth boundary.

A1—1 to 2 inches (2 to 6 centimeters); brown (10YR 5/3), broken face, loam, brown (10YR 4/3), broken face, moist; 28 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and

Figure 48.—Landscape of Literr and Merbeth soils. The hills are eroded terraces with rounded gravel visible in road cuts. Photo was taken in the Fremont Older Open Space near Saratoga. Merbeth soils occur on south slopes, and Literr soils occur on east, north, and west slopes. Vegetation is oaks and brush. Grass areas have been cleared and were farmed in the past.

common very fine roots; many fine interstitial pores; 5 percent subrounded 2- to 75-millimeter rock fragments; neutral, pH 6.7 by pH meter 1:1 water; clear smooth boundary.

A2—2 to 6 inches (6 to 15 centimeters); brown (10YR 4/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 28 percent clay; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and common very fine roots; few very fine tubular pores; 5 percent subrounded 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

ABt—6 to 13 inches (15 to 34 centimeters); brown (10YR 4/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 30 percent clay; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and moderately plastic; few fine and few very fine roots; many very fine tubular pores; 20 percent clay films on all faces of peds; 5 percent subrounded 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear wavy boundary.

Bt1—13 to 23 inches (34 to 59 centimeters); brown (10YR 4/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 34 percent clay; strong medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few fine roots; common very fine interstitial pores; 10 percent clay films on all faces of peds; 5 percent subrounded 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt smooth boundary.

Bt2—23 to 35 inches (59 to 90 centimeters); dark yellowish brown (10YR 4/6), broken face, clay loam, dark yellowish brown (10YR 3/6), broken face, moist; 38 percent clay; strong medium subangular blocky structure; hard, friable, moderately sticky

and moderately plastic; few fine roots; many very fine interstitial pores; 50 percent clay films on all faces of peds; 5 percent subrounded 2- to 75-millimeter rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water; abrupt smooth boundary.

B—35 to 45 inches (90 to 115 centimeters); dark yellowish brown (10YR 4/6), broken face, gravelly clay loam, dark yellowish brown (10YR 3/6), broken face, moist; 38 percent clay; strong medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine interstitial pores; 15 percent subrounded 2- to 75-millimeter rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt smooth boundary.

BC—45 to 57 inches (115 to 145 centimeters); brownish yellow (10YR 6/6), broken face, gravelly sandy clay loam, yellowish brown (10YR 5/6), broken face, moist; 28 percent clay; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine interstitial pores; 25 percent subrounded 2- to 75-millimeter rock fragments; neutral, pH 6.7 by pH meter 1:1 water; abrupt smooth boundary.

2C1—57 to 67 inches (145 to 170 centimeters); brownish yellow (10YR 6/6), broken face, sandy clay loam, dark yellowish brown (10YR 4/6), broken face, moist; 22 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent subrounded 2- to 75-millimeter rock fragments; neutral, pH 6.7 by pH meter 1:1 water; abrupt smooth boundary.

2C2—67 to 71 inches (170 to 180 centimeters); brownish yellow (10YR 6/6), broken face, sandy loam, dark yellowish brown (10YR 4/6), broken face, moist; 18 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent subrounded 2- to 75-millimeter rock fragments; neutral, pH 6.8 by pH meter 1:1 water; abrupt smooth boundary.

3C—71 to 74 inches (180 to 188 centimeters); brownish yellow (10YR 6/6), broken face, very gravelly sandy loam, dark yellowish brown (10YR 4/6), broken face, moist; 16 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores; 35 percent subrounded 2- to 75-millimeter rock fragments; neutral, pH 6.8 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 64 degrees F. The particle-size control section averages 35 to 45 percent clay and 2 to 15 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1.5 to 3 percent to a depth of 15 centimeters. Rock fragments on the surface range from 0 to 2 percent gravel.

The A horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 4/3, 4/2, 3/3, or 3/2. Texture is loam, clay loam, or sandy clay loam. Clay content ranges from 18 to 30 percent. Rock fragments range from 2 to 10 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The Bt and B horizons have dry color of 10YR 5/6, 5/4, 5/3, 4/4, 4/3, or 3/3 and moist color of 10YR 4/6, 4/4, 4/3, 3/6, or 3/4 or 2.5Y 4/4. Texture is clay loam, sandy clay loam, or sandy clay. Clay content ranges from 35 to 45 percent. Rock fragments range from 2 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The BC, 2C, and 3C horizons have dry color of 10YR 6/6 or 6/4 and moist color of 10YR 5/6 or 5/4. Texture is sandy loam, sandy clay loam, or clay loam. Clay content ranges from 16 to 35 percent. Rock fragments range from 5 to 35 percent gravel. Reaction ranges from pH 6.1 to 7.3.

Lodo Series

The Lodo series consists of shallow, well drained soils that formed in residuum from sandstone, schist, and shale (fig. 49). Lodo soils are on hills (fig. 50). Slopes range from 15 to 75 percent. The mean annual precipitation is about 30 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy, mixed, superactive, thermic Lithic Haploxerolls

Typical Pedon

Lodo gravelly sandy clay loam in an area of Lodo-Zeppelin complex, 30 to 50 percent slopes; Santa Clara County, California; Santa Teresa Hills County Park, southwest of Coyote Peak along a gravel road, north of the road on a southwest-facing 55 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 8 S., R. 2 E.; at an elevation of 1,930 feet; UTM Zone 10, Northing 4148059, Easting 600544, NAD83; USGS quadrangle: Santa Teresa Hills, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 2 centimeters); slightly decomposed plant material; loose, loose; abrupt smooth boundary.

A1—1 to 4 inches (2 to 10 centimeters); brown (10YR 5/3), broken face, gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 20 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores; 15 percent angular indurated 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.2 by pH meter 1:1 water; abrupt smooth boundary.

A2—4 to 9 inches (10 to 22 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores; 5 percent clay films on all faces of peds; 10 percent angular indurated 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.6 by pH meter 1:1 water; clear smooth boundary.

AC—9 to 17 inches (22 to 42 centimeters); brown (10YR 5/3), broken face, very gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 24 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine interstitial pores; 70 percent clay films on all faces of peds; 40 percent angular indurated 2- to 75-millimeter sandstone fragments; moderately acid, pH 5.7 by pH meter 1:1 water; abrupt smooth boundary.

R—17 inches (42 to 44 centimeters); strongly cemented sandstone.

Range in Characteristics

Depth to fine grained sandstone is 21 is 50 centimeters. The mean annual soil temperature is 59 to 61 degrees F. The particle-size control section averages 12 to 20 percent clay and 5 to 30 percent rock fragments, mostly gravel and cobbles. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 50 centimeters. Rock fragments on the surface range from 5 to 15 percent gravel.

The A horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 4/3, 3/3, or 3/2. Texture is fine sandy loam or very fine sandy loam. Clay content ranges from 12 to 18 percent. Rock fragments range from 5 to 20 percent gravel. Reaction ranges from 5.6 to 6.6.

Figure 49.—Representative profile of the Lodo series. It is located in Santa Teresa Hills County Park, southwest of Coyote Peak. These shallow soils are gravelly sandy clay loam and support mostly grasses with some brush. A lithic contact of hard sandstone occurs at a depth of 42 centimeters.

The AC horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 3/3. Texture is fine sandy loam. Clay content ranges from 12 to 20 percent. Rock fragments range from 5 to 20 percent gravel. Reaction ranges from pH 5.6 to 7.3.

The R layer is a lithic contact of fine grained and fractured hard sandstone.

Figure 50.—Landscape of Lodo soils. Photo was taken looking east toward Coyote Peak in Santa Teresa Hills County Park. These soils are on steeper slopes and in scattered spots. Zeppelin soils, which occur on the lower slopes, are fine textured and deep to soft bedrock. Small rock outcrops occur but are not visible in the grass.

Lompico Series

The Lompico series consists of moderately deep, well drained soils that formed in material weathered from sandstone, shale, conglomerate, and granodiorite. Lompico soils are on uplands and have slopes of 5 to 75 percent. The mean annual precipitation is about 48 inches, and the mean annual air temperature is about 55 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Ultic Argixerolls

Typical Pedon

Lompico loam; Santa Cruz County, California; about 1,700 feet north-northwest of Zayante Road Crossing of Mountain Charlie Gulch and 800 feet due west of Zayante Road, in a forested but recently harvested area, SW1/4 NE1/4 NE1/4 of section 36 (projected), T. 9 S., R. 2 W.; lat. 37 degrees 6 minutes 33 seconds N. and long. 122 degrees 1 minute 21 seconds W., NAD83; USGS quadrangle: Felton, California. (Colors are for dry soil unless otherwise noted.)

A—0 to 5 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse and common very fine roots; common very fine interstitial and fine tubular and many very fine tubular pores; slightly acid (pH 6.5); clear wavy boundary. (5 to 16 inches thick)

Bt1—5 to 11 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/2) moist; moderate coarse subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine and many coarse and medium roots; many very fine and fine tubular and common very fine interstitial pores; few thin clay films lining pores; strongly acid (pH 5.5); gradual wavy boundary.

Bt2—11 to 20 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common coarse and medium and few fine roots; many very fine and fine and common medium and coarse tubular pores; strongly acid (pH 5.5); gradual wavy boundary.

Bt3—20 to 29 inches; mixed brown (7.5YR 5/4) and strong brown (7.5YR 5/6) sandy clay loam, dark brown (7.5YR 4/4), broken face, and dark yellowish brown (10YR 4/4), rubbed, moist; moderate medium and coarse angular blocky structure; hard, friable, sticky and plastic; common coarse and medium and few fine roots; many very fine and common fine tubular pores and few very fine interstitial pores; many thin clay films lining pores and on faces of peds; moderately acid (pH 6.0); clear irregular boundary.

Bt4—29 to 37 inches; yellowish brown (10YR 5/4) shaly sandy clay loam, dark brown (10YR 4/3), broken face, and dark yellowish brown (10YR 4/4), rubbed, moist; moderate medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common coarse and medium and few fine roots; common fine and very fine tubular pores; common thin clay films as bridges between mineral grains and few thin clay films lining pores; estimated 60 percent soft, highly weathered shale and sandstone gravel; moderately acid (pH 6.0); diffuse broken boundary.

Cr—37 to 48 inches; soft, highly weathered sandstone that is easily crushed.

Range in Characteristics

Depth to a paralithic contact is 20 to 40 inches. The soil between depths of 6 and 16 inches typically becomes moist in mid-October or November and remains moist until the end of April. The mean annual soil temperature is about 56 to 58 degrees F. Organic matter is more than 1 percent above a depth of 10 inches and less than 1 percent below a depth of 20 inches. Base saturation is more than 50 percent in all parts and less than 75 percent in some or all parts of the profile to a depth of 30 inches. Small areas have O horizons consisting of leaf and twig litter. Rock fragments range mainly from 0 to 15 percent, by volume, gravel, except in the horizon immediately above the paralithic contact, which may contain up to 65 percent pebbles.

The A horizon is grayish brown or brown (10YR 5/2 or 5/3 or 7.5YR 5/2 or 5/4). Texture is sandy loam, fine sandy loam, very fine sandy loam, or loam. This horizon is slightly acid or neutral.

The Bt horizons are brown, yellowish brown, light yellowish brown, strong brown, reddish brown, or reddish yellow (10YR 5/3, 5/4, or 6/4; 7.5YR 4/4, 5/4, or 5/6; or 5YR 5/4 or 6/6). Texture is loam, sandy clay loam, or clay loam. These horizons range from very strongly acid to moderately acid.

Some pedons have a C horizon. This horizon is brown, pale brown, light yellowish brown, or reddish yellow (10YR 5/3, 6/3, or 6/4 or 7.5YR 6/8). Texture is sandy clay loam or clay loam. This horizon ranges from very strongly acid to moderately acid.

Lompico Taxadjunct

The Lompico taxadjunct consists of moderately deep, well drained soils on mountains. These soils formed in material weathered from sandstone, siltstone, shale, or mudstone. Slope ranges from 5 to 30 percent. The mean annual precipitation ranges from 35 to 45 inches, and the mean annual air temperature is about 56 degrees F.

Taxonomic Classification

Fine, montmorillonitic, mesic, Ultic Palexerolls

Typical Pedon

Lompico taxadjunct loam, 5 to 30 percent slopes; Santa Cruz County, California; about 1.51 miles north and 0.25 mile east of the fork of Granite Creek Road and Branciforte Drive, or about 2,350 feet south of the center of section 20, T. 10 S., R. 1 W. (projected); lat. 37 degrees 2 minutes 25 seconds N. and long. 121 degrees 59 minutes 33 seconds W., NAD83; USGS quadrangle: Laurel, California. (Colors are for dry soil unless otherwise noted.)

A1—0 to 5 inches (0 to 13 centimeters); dark grayish brown (10YR 4/2) loam, very dark brown (10YR2/2) moist; moderate fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine and common medium roots; many very fine and fine interstitial pores; slightly acid; gradual wavy boundary.

A2—5 to 10 inches (13 to 25 centimeters); dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; hard, friable, slightly sticky and slightly plastic; many medium, common fine and very fine, and few coarse roots; many fine or very fine interstitial pores between granules and few fine tubular pores; slightly acid; clear wavy boundary.

A3—10 to 14 inches (25 to 36 centimeters); dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse angular blocky structure; hard, friable, sticky and plastic; many fine, very fine, medium, and coarse roots; few pressure cutans; moderately acid; abrupt wavy boundary.

Bt1—14 to 19 inches (36 to 48 centimeters); mixed grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) clay, very dark grayish brown (10YR 3/2) and brown (7.5YR 4/4) moist; moderate medium and coarse angular blocky structure; extremely hard, firm, sticky and very plastic; many coarse and medium and common fine and very fine roots; many fine and very fine tubular pores; common moderately thick clay films on ped faces and lining pores; moderately acid; diffuse irregular boundary.

Bt2—19 to 23 inches (48 to 58 centimeters); variegated dark brown (7.5YR 4/2 or 4/4) and strong brown (7.5YR 5/6) clay, dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and dark brown (7.5YR 4/4) moist; dark yellowish brown (10YR 4/4) rubbed; moderate coarse and very coarse angular blocky structure; extremely hard, firm, very sticky and very plastic; common very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; common moderately thick clay films lining pores and on faces of peds; strongly acid; diffuse irregular boundary.

Bt3—23 to 28 inches (58 to 71 centimeters); clay that is variegated yellowish brown (10YR 5/4), brown (7.5YR 4/4), and very dark grayish brown (10YR 3/2), dry or moist; dark grayish brown (10YR 4/2) rubbed; moderate coarse and very coarse angular blocky structure; extremely hard, firm, very sticky and very plastic; common coarse and medium and few fine and very fine roots; many fine tubular pores; common thin and moderately thick clay films on faces of peds and lining pores; very strongly acid; diffuse irregular boundary.

Cr—28 to 36 inches (71 to 91 centimeters); weathered very strongly acid shale.

Range of Characteristics

Some profiles have an Oi horizon consisting of leaf and twig litter that is as much as 3 inches thick. Depth to a paralithic contact is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick. The profile has 0 to 10 percent gravel.

The A horizon has value of 3 or 5 and chroma of 2 or 3. Reaction ranges from moderately acid to neutral.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 6. Texture is heavy clay loam or clay. Reaction ranges from very strongly acid to moderately acid.

The Cr horizon is weathered sandstone, shale, siltstone, or mudstone.

These soils are considered a taxadjunt to the Lompico series because of the fine textured subsoil.

Los Gatos Series

The Los Gatos series consists of moderately deep, well drained soils that formed in residuum from sandstone, shale, and metasedimentary rocks. Los Gatos soils are on mountains. Slopes range from 10 to 75 percent. The mean annual precipitation is about 25 inches, and the mean annual air temperature is about 54 degrees F.

Taxonomic Classification

Fine-loamy, mixed, active, mesic Typic Argixerolls

Typical Pedon

Los Gatos clay loam in an area of Los Gatos gravelly loam, 50 to 75 percent slopes; Santa Clara County, California; on a road cut on Monte Bello Road, 1.5 miles southeast of Black Mountain on the crest of Monte Bello Ridge, in an area of annual grass and brush, in the southern part of the SW1/4 SE1/4 of section 19, T. 7 S., R. 2 W. (Colors are for dry soil unless otherwise noted.)

A1—0 to 6 inches (0 to 15 centimeters); brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 3/3) moist; strong medium granular structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine and very fine interstitial and few medium tubular pores; many wormcasts and rodent burrows; slightly acid (pH 6.5); clear smooth boundary.

A2—6 to 15 inches (15 to 38 centimeters); brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine and very fine interstitial and tubular and few medium tubular pores; common wormcasts and rodent burrows; slightly acid (pH 6.3); clear smooth boundary.

BAt—15 to 25 inches (38 to 64 centimeters); brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine and very fine interstitial and tubular and few medium tubular pores; many thin clay films in pores and on peds; slightly acid (pH 6.2); abrupt wavy boundary.

Bt—25 to 36 inches (64 to 91 centimeters); yellowish red (5YR 5/6) gravelly clay loam, reddish brown (5YR 4/5) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few medium and fine roots; many very fine interstitial and tubular and few fine and medium tubular pores; thin continuous clay films in pores and on peds; about 15 percent medium and fine shale fragments; moderately acid (pH 5.9); abrupt wavy boundary.

R—36 to 46 inches (91 to 117 centimeters); very pale brown (10YR 7/4) sandstone; reddish brown (5YR 4/4) clay films on rock faces in fractures; rock shattered in upper few inches, becoming nearly massive within a depth of 10 inches.

Range in Characteristics

Depth to sandstone is 24 to 40 inches. The soil between depths of about 5 and 12 inches typically is dry from sometime in May until sometime in October, and it is typically moist the rest of the year. The mean annual soil temperature is 54 to

58 degrees F, and the soil temperature is very briefly, if ever, below 47 degrees F. Typically, there are few rock fragments in the upper horizons and less than 35 percent in the lower horizons. The solum ranges from neutral to moderately acid. Typically, the A horizon is slightly acid and the Bt horizon is moderately acid.

The A horizon is mostly brown, dark brown, grayish brown, dark grayish brown, or yellowish brown with hue of 10YR or 7.5YR; in some pedons it is reddish brown with hue of 5YR. Moist value and moist chroma are 2 or 3. This horizon is fine sandy loam, loam, or clay loam. It has granular or subangular blocky structure or has crumb structure in the upper part. The lower boundary of the A horizon is gradual, or an AB or BA horizon occurs. The organic matter content ranges from 2 to 6 percent.

The Bt horizon is pinkish gray, light reddish brown, reddish yellow, brown, strong brown, or light brown with hue of 7.5YR or reddish brown or yellowish red with hue of 5YR. It is heavy loam, sandy clay loam, or clay loam and has less than 35 percent clay. Absolute clay increase from the A horizon to the Bt horizon ranges from about 5 to 9 percent. The Bt horizon has weak or moderate subangular blocky structure. In some pedons, it rests on bedrock. In other pedons, there is a brownish yellow or yellowish brown BC horizon or a C horizon above the bedrock.

Los Osos Series

The Los Osos series consists of moderately deep, well drained soils that formed in material weathered from sandstone and shale. Los Osos soils are on uplands and have slopes of 5 to 75 percent. The mean annual precipitation is about 25 inches, and the mean annual air temperature is about 60 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Typic Argixerolls

Typical Pedon

Los Osos loam; San Luis Obispo County, California; on the campus of California Polytechnic State University, on grazed rangeland, approximately 2,000 feet west and 1,500 feet south of the northeast corner of section 23, T. 30 S., R. 12 E., MDB&M; lat. 35 degrees 18 minutes 18 seconds N. and long. 120 degrees 39 minutes 23 seconds W.; USGS quadrangle: San Luis Obispo. (Colors are for dry soil unless otherwise noted.)

A—0 to 14 inches (0 to 36 centimeters); brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; moderately acid (pH 6.0); clear smooth boundary.

Btss1—14 to 24 inches (36 to 61 centimeters); yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; many moderately thick clay films on faces of peds and lining pores; few slickensides; moderately acid (pH 6.0); gradual wavy boundary.

Btss2—24 to 32 inches (61 to 81 centimeters); light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, sticky and plastic; few very fine roots, common very fine tubular pores; many moderately thick clay films lining pores; few slickensides; few manganese concretions; slightly acid (pH 6.5); gradual wavy boundary.

C—32 to 39 inches (81 to 99 centimeters); pale yellow (2.5Y 7/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, nonsticky and nonplastic; few manganese stains; neutral (pH 7.0); gradual wavy boundary.

Cr—39 to 43 inches (99 to 109 centimeters); yellowish brown (10YR 5/4) sandstone, brown (10YR 4/3) moist; many moderately thick clay films and few manganese

stains coating fracture faces that are less than 10 centimeters apart and less than 1 millimeter in width.

Range in Characteristics

Depth to a paralithic contact of sandstone or shale ranges from 20 to 40 inches. The mean annual soil temperature at a depth of 20 inches is 60 to 67 degrees F, and the coldest temperature is warmer than 41 degrees F. Between depths of about 4 and 12 inches, the soil is continuously dry after sometime in May until sometime in October. Some or all of the soil between these depths is moist all the rest of the time. There is a clay increase (absolute) of 6 to 15 percent from the A horizon to the Btss horizon. The soils lack an abrupt A/B horizon boundary.

The A horizon is grayish brown, dark grayish brown, brown, or dark brown with hue of 10YR or 7.5YR and moist value of 3 or 2. It is loam, silt loam, clay loam, or silty clay loam and has weak to strong structure. This horizon has 2 to 4 percent organic matter. It ranges from moderately acid to neutral.

The Btss horizon is brown, dark brown, grayish brown, dark grayish brown, light yellowish brown, yellowish brown, dark yellowish brown, brownish yellow, pale brown, light olive brown, light brown, or light brownish gray with hue of 10YR, 7.5YR, or 2.5Y. In most pedons, it has one unit higher value and one or two units brighter chroma than the A horizon. The Btss horizon is heavy clay loam, clay, or silty clay and averages 35 to 50 percent clay. It has weak to strong angular or subangular blocky structure or in some pedons is prismatic in the upper part and massive in the lower part. It ranges from moderately acid to neutral.

Some pedons have a C horizon consisting of a weathering front. The C horizon is sandy loam, loam, or clay loam.

Madonna Series

The Madonna series consists of moderately deep, well drained soils that formed in material weathered in residuum from sandstone and shale. Madonna soils are on uplands and have slopes of 15 to 75 percent. The mean annual precipitation is about 45 inches, and the mean annual air temperature is about 53 degrees F.

Taxonomic Classification

Fine-loamy, mixed, active, mesic Typic Dystroxerepts

Typical Pedon

Madonna loam, 15 to 30 percent slopes; Santa Clara County, California; 50 feet upslope from the intersection of Old Watsonville Road and Summit Road, in rangeland, in the southeast corner of NW1/4 NW1/4 of section 21, T. 10 S., R. 2 E. (Colors are for dry soil unless otherwise noted.)

A—0 to 7 inches (0 to 18 centimeters); pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; moderate medium and fine granular structure; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores and few medium tubular pores; moderately acid (pH 5.6); clear wavy boundary. (6 to 16 inches thick)

B—7 to 25 inches (18 to 64 centimeters); brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores and few medium tubular pores; few thin clay films on faces of peds and lining pores; moderately acid (pH 5.6); clear wavy boundary. (14 to 24 inches thick)

Cr—25 to 30 inches (64 to 76 centimeters); light yellowish brown (10YR 6/4) strongly acid, moderately hard and fractured sandstone; brown stains occur along fracture planes; fractures more than 10 centimeters apart.

Range in Characteristics

Depth to a paralithic contact ranges from 20 to 40 inches. The mean annual soil temperature is about 52 to 56 degrees F. The soil between depths of 5 to 15 inches is typically moist all of the time from October or early November until May or June. It is typically dry all the rest of the year. Rock fragments, typically gravel, range from 1 to 35 percent. Base saturation is 35 to 60 percent in all parts but may be more than 60 percent in the surface layer.

The A horizon is pale brown, light brownish gray, light brown, brown, dark brown, grayish brown, or dark grayish brown with hue of 10YR or 7.5YR. It has dry values of 4 or 5, which are confined to the upper 1 to 6 inches. The A horizon is commonly loam and less commonly fine sandy loam or light clay loam. It has weak or moderate structure and is slightly or moderately acid.

The B horizon is commonly pale brown, light yellowish brown, very pale brown, brown, or light brown. Hue is 10YR or 7.5YR; value or chroma, or both, are one unit higher in some pedons. The horizon is loam, heavy loam, or light clay loam and is similar to or only slightly finer than the A horizon. The B horizon has weak or moderate structure and has common to very thin clay films. It is tyically moderately acid or strongly acid, but part of the horizon is very strongly acid in some pedons. Some pedons have a C horizon of soil material similar in color and texture to the B horizon.

Maymen Series

The Maymen series consists of shallow, well drained soils that formed in residuum from schist, sandstone, and greenstone (fig. 51). Maymen soils are on mountains (fig. 52). Slopes range from 8 to 75 percent. The mean annual precipitation is about 40 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy, mixed, active, thermic shallow Typic Dystroxerepts

Typical Pedon

Maymen gravelly sandy clay loam in an area of Maymen gravelly sandy clay loam, 30 to 50 percent slopes; Santa Clara County, California; along Page Mill Road at Gate 4 of Foothill Park, through the gate uphill to the west, about 100 feet south on a small trail, south into brush, on a south-facing 25 percent slope under a cover of chamise, in a nonsectionized area of T. 7 S., R. 3 W.; at an elevation of 1,760 feet; UTM Zone 10, Northing 4133542, Easting 572451, NAD83; USGS quadrangle: Mindego Hill, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 2 inches (0 to 6 centimeters); yellowish brown (10YR 5/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 22 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine irregular pores; 20 percent angular strongly cemented 2- to 75-millimeter schist fragments; strongly acid, pH 5.6 by pH meter 1:1 water; clear smooth boundary.

Bw1—2 to 7 inches (6 to 17 centimeters); brown (7.5YR 5/4), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 24 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine irregular pores; 25 percent angular strongly cemented 2- to 75-millimeter schist fragments; strongly acid, pH 5.5 by pH meter 1:1 water; clear smooth boundary.

Bw2—7 to 10 inches (17 to 25 centimeters); brown (7.5YR 5/4), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 24 percent clay;

Figure 51.—Representative profile of the Maymen series. These shallow brown soils do not have a clay increase in the Bw horizon that is enough for an argillic horizon. Angular rock fragments are visible throughout the profile and increase in amount with depth. The highly fractured and weathered schist contact is at a depth of 25 centimeters.

massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine irregular pores; 30 percent angular strongly cemented 2- to 75-millimeter schist fragments; strongly acid, pH 5.3 by pH meter 1:1 water; abrupt smooth boundary.

Cr—10 to 15 inches (25 to 38 centimeters); moderately hard, highly fractured schist; 2 percent soil material in cracks near upper boundary; becomes more solid

Figure 52.—Landscape of Maymen soils. Photo was taken at the type location in Foothill Park, along Page Mill Road, west of Palo Alto. Maymen soils are in the foreground covered by brush with some bare spots. Los Trancos Woods in San Mateo County is in the background.

with depth; fragments are typically 3 to 6 centimeters in size but range to 10 centimeters.

Range in Characteristics

Depth to highly fractured and slightly weathered bedrock is 16 to 43 centimeters. The mean annual soil temperature is 59 to 62 degrees F. The soil moisture control section is dry in all parts from about May 15 to November 15 (about 180 days). The particle-size control section averages 8 to 22 percent clay and 15 to 35 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 0.25 to 1 percent to a depth of 43 centimeters. Base saturation by sum of cation ranges from 35 to 60 percent to a depth of 43 centimeters. Rock fragments on the surface range from 25 to 60 percent gravel.

The A horizon has dry color of 10YR 6/4, 6/3, 5/4, or 5/3 or 7.5YR 6/4, 6/3, 5/4, 5/3, or 4/6 and moist color of 10YR 4/4, 4/3, or 3/4 or 7.5YR 4/4 or 3/4. Texture is loam, sandy clay loam, sandy loam, or coarse sandy loam. Clay content ranges from 8 to 22 percent. Rock fragments range from 12 to 35 percent gravel. Reaction ranges from pH 5.3 to 6.8.

The Bw horizon has dry color of 10YR 7/3, 6/4, or 5/4 or 7.5YR 6/4, 5/4, 4/6, or 4/4 and moist color of 10YR 5/4, 5/3, or 5/4 or 7.5YR 5/4, 4/4, 3/4, or 2.5/3. Texture is loam, sandy clay loam, sandy loam, or coarse sandy loam. Clay content ranges from 10 to 24 percent. Rock fragments range from 15 to 45 percent gravel; gravel content increases to 45 percent within several centimeters of the paralithic contact. Reaction ranges from pH 5.3 to 6.8.

McCoy Series

The McCoy series consists of moderately deep, well drained soils that formed in residuum from sandstone (fig. 53). McCoy soils are on hills (see figure 82). Slopes range from 5 to 30 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

McCoy very fine sandy loam in an area of Zeppelin-McCoy complex, 15 to 30 percent slopes; Santa Clara County, California; Stanford University Academic Preserve, west of a large satellite dish, south and west of a recreation trail to the creek, on a north-facing 20 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 6 S., R. 3 W.; at an elevation of 460 feet; UTM Zone 10, Northing 4140660, Easting 572199, NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 2 inches (0 to 6 centimeters); dark grayish brown (10YR 4/2), broken face, very fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 18 percent clay; strong medium subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; many very fine roots; many very fine interstitial and few very fine tubular pores; moderately acid, pH 5.7 by pH meter 1:1 water; clear smooth boundary.

A2—2 to 9 inches (6 to 22 centimeters); dark grayish brown (2.5Y 4/2), broken face, sandy clay loam, very dark grayish brown (2.5Y 3/2), broken face, moist; 20 percent clay; weak medium subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common very fine roots; many very fine interstitial and common very fine tubular pores; 5 percent clay films on all faces of peds; moderately acid, pH 5.8 by pH meter 1:1 water; clear smooth boundary.

Bt1—9 to 16 inches (22 to 40 centimeters); dark grayish brown (2.5Y 4/2), broken face, sandy clay loam, very dark grayish brown (2.5Y 3/2), broken face, moist; 24 percent clay; moderate coarse subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few very fine roots; many very fine interstitial and common very fine tubular pores; 50 percent clay films on all faces of peds; 5 percent dark yellowish brown (10YR 4/6), moist, and brownish yellow (10YR 6/6), dry, masses of oxidized iron and 20 percent dark grayish brown (10YR 4/2), moist, and light brownish gray (10YR 6/2), dry, iron depletions; moderately acid, pH 5.9 by pH meter 1:1 water; clear smooth boundary.

Bt2—16 to 28 inches (40 to 72 centimeters); dark grayish brown (2.5Y 4/2), broken face, sandy clay loam, very dark grayish brown (2.5Y 3/2), broken face, moist; 27 percent clay; moderate coarse subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few very fine roots; many very fine interstitial and common very fine tubular pores; 80 percent clay films on all faces of peds; slightly acid, pH 6.2 by pH meter 1:1 water; abrupt wavy boundary.

Cr—28 to 32 inches (72 to 82 centimeters); weakly cemented, fine grained sandstone.

Range in Characteristics

Depth to weakly cemented sandstone is 55 to 92 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about May 1 to November 1 (about 180 days). The particle-size control section averages 25 to 35 percent clay and 0 to 5 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 20 centimeters.

Figure 53.—Representative profile of the McCoy series. It is located on the Stanford University Academic Preserve. The dark grayish brown A horizon extends to a depth of 22 centimeters. Below 22 centimeters is the dark grayish brown sandy clay loam Bt horizon. This horizon has few rock fragments and a clay content of less than 35 percent. The soft Cr horizon is at a depth of 72 centimeters. The weathered sandstone can be easily dug with a spade.

The A horizon has dry color of 10YR 4/3 or 4/2 or 2.5Y 5/3 and moist color of 10YR 3/3, 3/2, or 2/2 or 2.5Y 3/3 or 3/2. Texture is very fine sandy loam, sandy clay loam, or loam. Clay content ranges from 18 to 25 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 5.6 to 6.6.

The Bt horizon has dry color of 10YR 6/4 or 5/4 or 2.5Y 5/4 or 4/2 and moist color of 10YR 4/4 or 2.5Y 3/4 or 3/2. Texture is sandy clay loam or clay loam. Clay content ranges from 24 to 35 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 5.1 to 7.3.

Merbeth Series

The Merbeth series consists of very deep, well drained soils that formed in old alluvium from mixed rock sources (fig. 54). Merbeth soils are on eroded terraces (see figure 48). Slopes range from 15 to 30 percent. The mean annual precipitation is about 24 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, mixed, superactive, thermic Mollic Palexeralfs

Typical Pedon

Merbeth gravelly sandy clay loam in an area of Literr-Merbeth complex, 15 to 30 percent slopes; Santa Clara County, California; Older Fremont Open Space, north of Gate FO02, about 0.25 mile from the gate, up the south slope to an upper slope, on a south-facing 26 percent slope under a cover of wild oats and vetch, in section 26, T. 7 S., R. 2 W.; at an elevation of 236 meters; UTM Zone 10, Northing 4127361, Easting 583426, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 3 centimeters); slightly decomposed plant material; abrupt smooth boundary.

A1—1 to 2 inches (3 to 6 centimeters); brown (10YR 4/3), broken face, gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 25 percent clay; strong medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 15 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt smooth boundary.

A2—2 to 5 inches (6 to 13 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 26 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine irregular pores; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; slightly acid, pH 6.2 by pH meter 1:1 water; clear smooth boundary.

A3—5 to 12 inches (13 to 30 centimeters); dark yellowish brown (10YR 4/4), broken face, sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 28 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine irregular pores; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; slightly acid, pH 6.3 by pH meter 1:1 water; gradual smooth boundary.

Bt1—12 to 20 inches (30 to 50 centimeters); dark yellowish brown (10YR 4/4), broken face, sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 34 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine irregular pores; 30 percent clay films on all faces of peds; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; moderately acid, pH 6.1 by pH meter 1:1 water; gradual smooth boundary.

Bt2—20 to 36 inches (50 to 92 centimeters); yellowish brown (10YR 5/4), broken face, clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 38 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine irregular pores; 30 percent clay films on

Figure 54.—Representative profile of the Merbeth series. Photo was taken at the Fremont Older Open Space near Saratoga. These well developed terrace soils have a distinctive Bt horizon with 32 to 45 percent clay. Clay content of the Bt horizon does not decrease significantly within 150 centimeters of the soil surface.

all faces of peds; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; moderately acid, pH 6.1 by pH meter 1:1 water; clear smooth boundary.

Bt3—36 to 59 inches (92 to 150 centimeters); yellowish brown (10YR 5/4), broken face, sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 35 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine irregular pores; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

Bt4—59 to 71 inches (150 to 180 centimeters); yellowish brown (10YR 5/4), broken face, sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 35 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine irregular pores; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; neutral, pH 7.1 by pH meter 1:1 water; clear smooth boundary.

Bt5—71 to 83 inches (180 to 210 centimeters); yellowish brown (10YR 5/4), broken face, sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 32 percent clay; moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; many very fine irregular pores; 5 percent subrounded indurated 2- to 50-millimeter mixed rock fragments; neutral, pH 6.9 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 15 to October 15 (about 120 days). The particle-size control section averages 32 to 45 percent clay and 5 to 35 percent rock fragments, mostly gravel. Mineralogy is mixed. Organic matter content ranges from 1 to 3 percent to a depth of 30 centimeters. Rock fragments on the surface range from 0 to 5 percent and are 2 to 50 millimeters in size.

The A horizon has dry color of 10YR 5/3, 4/4, or 4/3 and moist color of 10YR 4/3, 3/4, or 3/3. Texture is sandy clay loam. Clay content ranges from 25 to 32 percent. Rock fragments range from 1 to 15 percent and are 2 to 50 millimeters in size. Reaction ranges from pH 6.1 to 7.3.

The Bt horizon has dry color of 10YR 5/6, 5/4, or 4/4 and moist color of 10YR 5/6, 4/4, or 4/3. Texture is sandy clay loam or sandy clay. Clay content ranges from 32 to 45 percent. Rock fragments range from 5 to 35 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 6.1 to 7.3.

Minlum Series

The Minlum series consists of very deep, well drained soils that formed in colluvium from terrace deposits (fig. 55). Minlum soils are on mountains (fig. 56). Slopes range from 15 to 65 percent. The mean annual precipitation is about 22 inches, and the mean annual temperature is about 58 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Minlum sandy loam in an area of Airship-Minlum complex, 40 to 65 percent slopes; Santa Clara County, California; Stevens Creek County Park, Cupertino, on PG&E road to Coyote Ridge, across the first creek near the bottom of the ridge about 200 feet, on the east side of the road and upslope, on a north-facing 60 percent slope under a

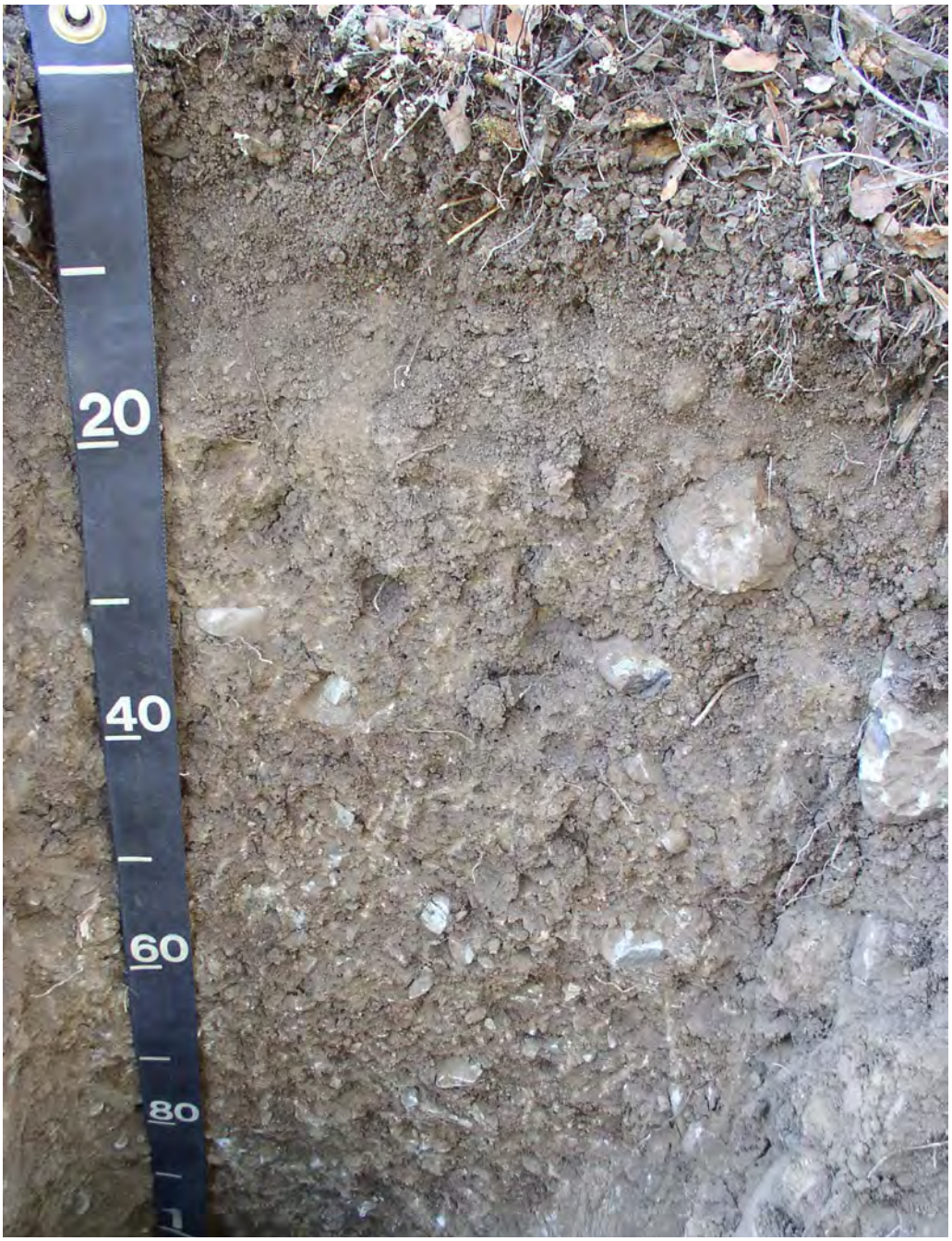


Figure 55.—Representative profile of the Minlum series. Minlum soils formed in colluvium from eroded terraces. The A horizon to a depth of 30 centimeters is porous sandy clay loam. Rounded and subrounded fragments occur throughout the profile. Some fragments have been fractured in transport; some of the ones visible in the photo were fractured during excavation. A Bt horizon occurs to a depth of 120 centimeters below the A horizon. The Bt horizon has a moderate increase in clay content but is still sandy clay loam.

cover of live oak, in section 27, T. 7 S., R. 2 W.; at an elevation of 150 meters; UTM Zone 10, Northing 4128499, Easting 582143, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Figure 56.—Landscape of Minlum soils. Photo was taken in Stevens Creek County Park near Cupertino; the pit was excavated along a PG&E road to Coyote Ridge. Oaks cover most of the area with some brush; poison oak and grasses are in the understory. Slopes are steep.

A1—0 to 4 inches (0 to 11 centimeters); dark grayish brown (10YR 4/2), broken face, sandy loam, very dark brown (10YR 2/2), broken face, moist; 18 percent clay; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; many very fine interstitial pores; 10 percent subrounded indurated 2- to 75-millimeter rock fragments; neutral, pH 6.9 by pH meter 1:1 water; abrupt smooth boundary.

A2—4 to 12 inches (11 to 30 centimeters); dark grayish brown (10YR 4/2), broken face, sandy clay loam, very dark brown (10YR 2/2), broken face, moist; 21 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few medium roots; many very fine interstitial pores; 30 percent clay films on all faces of peds; 10 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear smooth boundary.

ABt—12 to 20 inches (30 to 50 centimeters); brown (10YR 4/3), broken face, gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 25 percent clay; strong medium subangular blocky structure; slightly hard, friable, moderately sticky and slightly plastic; few medium roots; common fine tubular and many very fine interstitial pores; 70 percent clay films on all faces of peds; 15 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

Bt1—20 to 35 inches (50 to 90 centimeters); dark yellowish brown (10YR 4/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 26 percent clay; strong medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few medium roots; common fine

tubular and many very fine interstitial pores; 40 percent clay films on all faces of peds; 20 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

Bt2—35 to 47 inches (90 to 120 centimeters); dark yellowish brown (10YR 4/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 24 percent clay; strong medium subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common fine interstitial pores; 10 percent clay films between sand grains; 10 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water; clear smooth boundary.

BC—47 to 61 inches (120 to 155 centimeters); yellowish brown (10YR 5/4), broken face, fine sandy loam, dark yellowish brown (10YR 3/4), broken face, moist; 18 percent clay; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine interstitial pores; 10 percent subrounded indurated 2- to 75-millimeter rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 57 to 59 degrees F. The soil moisture control section is dry in all parts from about June 15 to October 15 (about 120 days). The particle-size control section averages 20 to 30 percent clay and 10 to 40 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are noncalcareous. Organic matter content ranges from 1 to 3 percent to a depth of 30 centimeters. Rock fragments on the surface range from 0 to 10 percent gravel.

The A and ABt horizons have dry color of 10YR 5/4, 5/3, 4/3, or 4/2 and moist color of 10YR 4/3, 3/4, 3/3, or 2/2. Texture is sandy loam, fine sandy loam, or sandy clay loam. Clay content ranges from 16 to 24 percent. Rock fragments range from 10 to 25 percent and are mostly gravel. Reaction ranges from pH 6.1 to 7.8.

The Bt horizon has dry color of 10YR 6/6, 6/4, 5/6, 5/4, or 4/4 and moist color of 10YR 5/6, 5/4, 4/4, or 3/4. Texture is sandy clay loam. Clay content ranges from 20 to 30 percent. Rock fragments range from 10 to 35 percent and are mostly gravel. Reaction ranges from pH 6.1 to 7.3.

The BC horizon has dry color of 10YR 6/6, 5/4, or 4/3 and moist color of 10YR 5/6, 4/4, or 3/3. Texture is sandy clay loam. Clay content ranges from 20 to 27 percent. Rock fragments range from 10 to 35 percent and are mostly gravel. Reaction ranges from pH 6.1 to 7.3.

Montara Series

The Montara series consists of shallow, somewhat excessively drained soils that formed in residuum from serpentinitic rock (fig. 57). Montara soils are on mountain slopes (fig. 58). Slopes range from 15 to 50 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy, magnesic, thermic Lithic Haploxerolls

Typical Pedon

Montara sandy loam, 15 to 50 percent slopes; Santa Clara County, California; Dana Rock Park, City of San Jose, on a ridge north of rock outcrops and 40 meters down an east-facing slope, on a south-facing 25 percent slope under a cover of annual grasses and star thistle, in a nonsectionized area of T. 8 S., R. 1 E.; at an elevation of 197 feet; lat. 37 degrees 16 minutes 23.9 seconds N. and long. 122 degrees 49 minutes 25.8

Figure 57.—Representative profile of the Montara series. This shallow soil, which developed from serpentinite, has a hard lithic contact of serpentinite at a depth of 45 centimeters. Fractured serpentinite is visible below a depth of 30 centimeters. Texture is gravelly sandy loam to a depth of 29 centimeters and cobbly sandy loam to a depth of 45 centimeters.

seconds W., NAD83; USGS quadrangle: San Jose East, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 4 inches (0 to 10 centimeters); brown (10YR 4/3), broken face, sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 5 percent angular strongly cemented 75- to 254-millimeter serpentinite fragments and 10 percent angular strongly cemented

Figure 58.—Landscape of Montara soils in Santa Teresa Hills County Park. Numerous rock outcrops are visible. Some areas have fewer rock outcrops. Alo and Altamont soils are on the hills in the background, which developed from sandstone.

2- to 75-millimeter serpentinite fragments; neutral, pH 7.1 by pH meter 1:1 water; abrupt smooth boundary.

A2—4 to 11 inches (10 to 29 centimeters); brown (10YR 4/3), broken face, gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 15 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular and many very fine irregular pores; 5 percent angular strongly cemented 75- to 254-millimeter serpentinite fragments and 15 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; neutral, pH 7.2 by pH meter 1:1 water; abrupt wavy boundary.

A3—11 to 18 inches (29 to 45 centimeters); brown (10YR 4/3), broken face, cobbly sandy loam, dark brown (10YR 3/3), broken face, moist; 17 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular and few very fine tubular pores; 15 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments and 15 percent angular strongly cemented 75- to 254-millimeter serpentinite fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt wavy boundary.

R—18 to 21 inches (45 to 54 centimeters); hard serpentinite.

Range in Characteristics

Depth to bedrock is 10 to 50 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section is 25 to 50 centimeters

thick and averages 15 to 30 percent clay and 5 to 35 percent rock fragments, mostly gravel. Mineralogy is magnesic. Organic matter content ranges from 1.5 to 0.75 percent to a depth of 45 centimeters. Rock fragments on the surface range from 5 to 10 percent gravel, cobbles, and stones.

The A1 horizon has dry color of 10YR 4/3 and moist color of 10YR 3/3. Texture is loam, sandy loam, gravelly loam, or gravelly sandy loam. Clay content ranges from 15 to 25 percent. Rock fragments range from 5 to 35 percent gravel and cobbles. Reaction ranges from pH 6.6 to 7.8.

The A2 horizon has dry color of 10YR 4/3 and moist color of 10YR 3/3. Texture is sandy loam, loam, sandy clay loam, gravelly sandy loam, gravelly loam, or gravelly sandy clay loam. Clay content ranges from 15 to 35 percent. Rock fragments range from 5 to 35 percent gravel and cobbles. Reaction ranges from pH 6.6 to 7.8.

The A3 horizon has dry color of 10YR 4/3 and moist color of 10YR 3/3. Texture is sandy loam, sandy clay loam, clay loam, gravelly sandy loam, cobbly sandy loam, or gravelly sandy clay loam. Clay content ranges from 15 to 35 percent. Rock fragments range from 5 to 35 percent gravel and cobbles. Reaction ranges from pH 6.6 to 7.8.

Montavista Series

The Montavista series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 59). Montavista soils are on terraces (fig. 60). Slopes range from 15 to 30 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Typic Argixerolls

Typical Pedon

Montavista clay loam, 15 to 30 percent slopes; Santa Clara County, California; south of Cristo Rey Drive, Cupertino, in county park, west of the creek on a park trail, 20 meters downhill from the trail, on a southeast-facing 25 percent slope under a cover of annual grasses and oaks, in a nonsectionized area of T. 7 S., R. 2 W.; at an elevation of 120 meters; UTM Zone 10, Northing 4132196, Easting 581726, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 2 inches (0 to 5 centimeters); brown (10YR 4/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 33 percent clay; strong very fine granular, strong fine granular, and moderate fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; many very fine roots; many very fine interstitial pores; 10 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt smooth boundary. (5 to 19 centimeters thick)

A2—2 to 9 inches (5 to 24 centimeters); brown (10YR 4/3), broken face, clay loam, dark brown (10YR 3/3), broken face, moist; 33 percent clay; strong medium and strong fine subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common very fine roots; common very fine tubular and many very fine interstitial pores; 30 percent clay films on all faces of peds; 5 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.2 by pH meter 1:1 water; abrupt smooth boundary. (0 to 27 centimeters thick)

ABt—9 to 17 inches (24 to 42 centimeters); brown (7.5YR 4/3), broken face, clay loam, dark brown (7.5YR 3/3), broken face, moist; 35 percent clay; moderate medium subangular blocky structure; slightly hard, friable, moderately sticky and

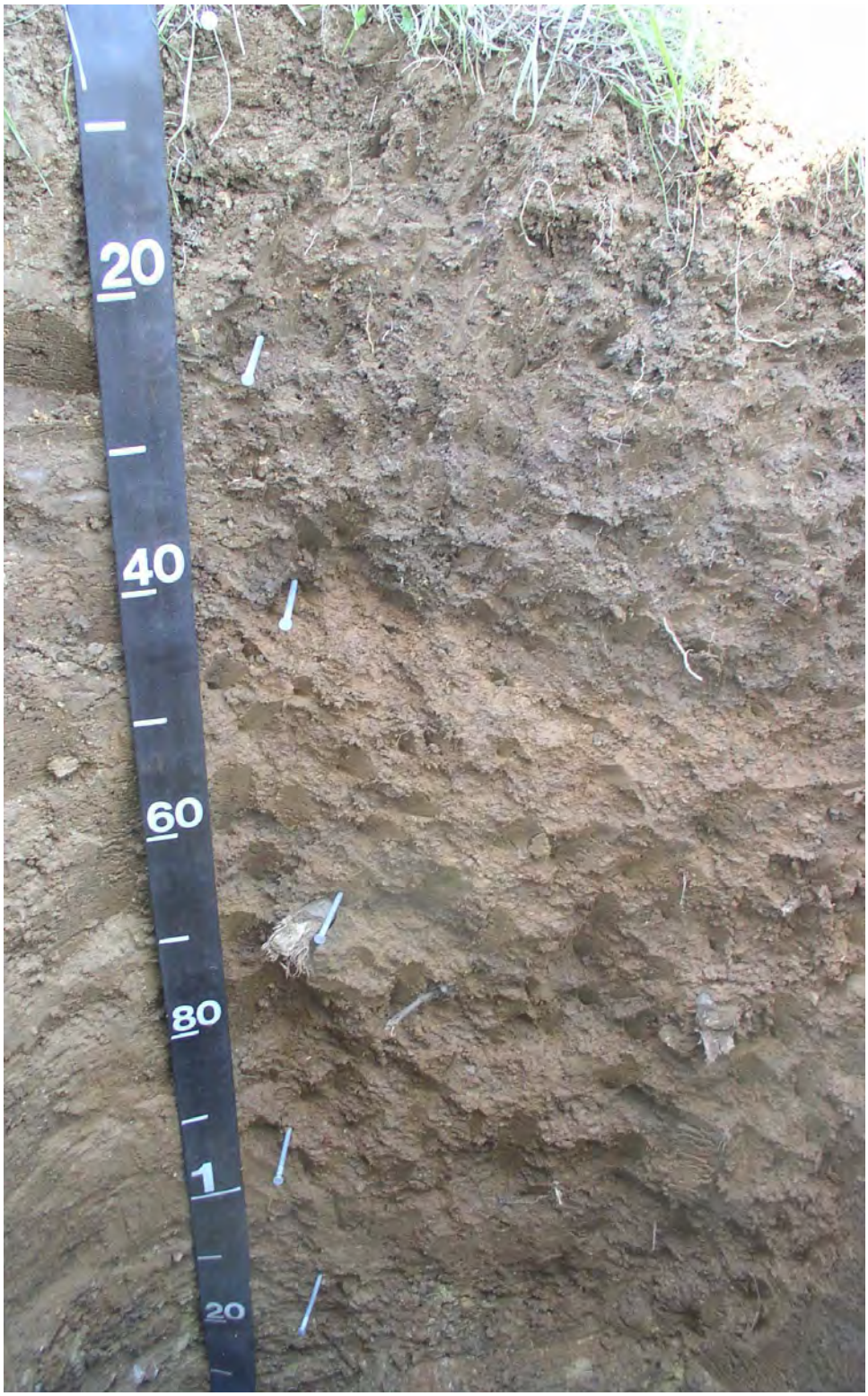


Figure 59.—Representative profile of the Montavista series. This terrace soil has a 24-centimeter-thick A horizon of clay loam. The Bt horizon, which extends to a depth of 94 centimeters, has a clay increase of 10 percent or more and is clay loam or clay. The B horizon is at depth of 94 to 116 centimeters. Below this is a distinctive very gravelly BC horizon that is transitional to a 2B horizon of gravelly sandy clay loam (at a depth of 178 centimeters).

Figure 60.—Landscape of Montavista and Togasara soils. These dissected terraces occur on the west side of Cupertino. Photo was taken near the Montavista type location on County Park property, south of Cristo Rey Drive. On the distinctive rolling ridges, Montavista soils and the more gravelly Togasara soils occur mixed in a random pattern. Both have grass cover and scattered oaks. Housing has been constructed on most of these soils and is visible in the photo. The Santa Cruz Mountains, Los Altos Hills, and Freeway 280 are in the background.

moderately plastic; common very fine roots; common very fine tubular pores; 60 percent clay films on all faces of peds; 5 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.2 by pH meter 1:1 water; abrupt wavy boundary. (12 to 27 centimeters thick)

Bt1—17 to 26 inches (42 to 67 centimeters); brown (7.5YR 4/4), broken face, clay, brown (7.5YR 4/4), broken face, moist; 45 percent clay; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; 80 percent clay films on all faces of peds; 5 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water; abrupt smooth boundary. (15 to 30 centimeters thick)

Bt2—26 to 37 inches (67 to 94 centimeters); strong brown (7.5YR 5/6), broken face, clay loam, strong brown (7.5YR 4/6), broken face, moist; 39 percent clay; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common coarse roots; common very fine tubular pores; 80 percent clay films on all faces of peds; 5 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt smooth boundary. (20 to 45 centimeters thick)

B—37 to 46 inches (94 to 116 centimeters); strong brown (7.5YR 5/6), broken face, clay loam, strong brown (7.5YR 4/6), broken face, moist; 32 percent clay; moderate medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; common very coarse roots; common very fine tubular pores; 10

percent clay films on rock fragments; 10 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; abrupt smooth boundary. (0 to 22 centimeters thick)

BC—46 to 70 inches (116 to 178 centimeters); strong brown (7.5YR 5/6), broken face, very gravelly sandy clay loam, strong brown (7.5YR 4/6), broken face, moist; 22 percent clay; massive; slightly hard, friable, slightly sticky and slightly plastic; 50 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; neutral, pH 7.0 by pH meter 1:1 water; abrupt wavy boundary. (0 to 35 centimeters thick)

2B—70 to 81 inches (178 to 205 centimeters); reddish yellow (7.5YR 6/6), broken face, gravelly sandy clay loam, strong brown (7.5YR 5/6), broken face, moist; 25 percent clay; massive; slightly hard, friable, slightly sticky and slightly plastic; 15 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; neutral, pH 7.2 by pH meter 1:1 water.

Range in Characteristics

Depth to the Bt horizon ranges from 20 to 45 centimeters. The mean annual soil temperature is 62 to 64 degrees F. The soil moisture control section is dry in all parts from about June 15 to October 15 (about 120 days). The particle-size control section averages 35 to 45 percent clay and 5 to 15 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are noncalcareous. Organic matter content ranges from 1 to 3 percent to a depth of 15 centimeters. Rock fragments on the surface range from 0 to 10 percent gravel. Some pedons have a C horizon of very gravelly sandy clay loam or sandy loam.

The A and ABt horizons have dry color of 10YR 4/3 or 7.5YR 4/3 and moist color of 10YR 3/3 or 7.5YR 3/3. Texture is clay loam or sandy clay loam. Clay content ranges from 27 to 45 percent. Rock fragments range from 5 to 10 percent gravel. Reaction ranges from pH 6.1 to 6.6.

The Bt horizons have dry color of 10YR 5/4, 5/3, or 4/3 or 7.5YR 6/6, 5/6, or 4/4 and moist color of 10YR 4/4 or 4/3 or 7.5YR 4/6 or 4/4. Texture is clay, clay loam, or sandy clay loam. Clay content ranges from 35 to 45 percent. Rock fragments range from 5 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The B, BC, and 2B horizons have dry color of 10YR 6/6 or 6/4 or 7.5YR 6/6 or 5/6 and moist color of 10YR 5/4 or 4/6 or 7.5YR 5/6 or 4/6. Texture is clay loam or sandy clay loam. Clay content ranges from 22 to 32 percent. Rock fragments range from 10 to 50 percent gravel. Reaction ranges from pH 6.6 to 7.3.

Mouser Series

The Mouser series consists of deep and very deep, well drained soils that formed in residuum weathered from greenstone (fig. 61). Mouser soils are on summits and the side slopes of mountains and hills. Slopes range from 8 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual air temperature is about 57 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls

Typical Pedon

Mouser gravelly loam in an area of Mouser-Maymen complex, 30 to 75 percent slopes; Santa Clara County, California; Monte Bello Open Space, Black Mountain north of the towers, past Gate WP03 on Black Mountain Trail, east about 200 feet near a large buckeye, 50 feet north of the trail, on a north-facing (20 degree) 35 percent slope, in section 13, T. 7 S., R. 3 W.; at an elevation of 844 meters; UTM Zone 10, Northing

Figure 61.—Representative profile of the Mouser series. These extensive soils occur throughout the Santa Cruz Mountains of the Franciscan Formation east of the San Andreas Fault. They are brown throughout with an A horizon extending to a depth of 41 centimeters. Gravel occur throughout the soil profile, increasing in content above the paralithic rock contact at a depth of 145 centimeters. The argillic horizon at depths of 41 to 95 centimeters has a slight increase in clay. Mouser soils have oaks, madrone, and bay laurel tree cover with an understory of brush and poison oak.

4130699, Easting 575501, NAD83; USGS quadrangle: Mindego Hill, California. When described on October 17, 2005, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 2 inches (0 to 5 centimeters); slightly decomposed plant material; 20 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; abrupt smooth boundary.

A1—2 to 3 inches (5 to 8 centimeters); brown (7.5YR 4/2), broken face, gravelly loam, very dark brown (7.5YR 2.5/2), broken face, moist; 22 percent clay; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common

very fine roots; many very fine interstitial pores; 20 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; moderately acid, pH 5.9 by pH meter 1:1 water; clear wavy boundary.

A2—3 to 10 inches (8 to 25 centimeters); brown (7.5YR 4/2), broken face, gravelly loam, very dark brown (7.5YR 2.5/2), broken face, moist; 23 percent clay; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common very fine roots; many very fine interstitial pores; 20 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; slightly acid, pH 6.3 by pH meter 1:1 water; clear wavy boundary.

A3—10 to 16 inches (25 to 41 centimeters); brown (7.5YR 4/2), broken face, gravelly loam, very dark brown (7.5YR 2.5/2), broken face, moist; 23 percent clay; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; few fine and common very fine roots; many very fine interstitial pores; 20 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; moderately acid, pH 6.0 by pH meter 1:1 water; abrupt wavy boundary.

Bt1—16 to 28 inches (41 to 70 centimeters); brown (7.5YR 4/2), broken face, gravelly loam, very dark brown (7.5YR 2.5/2), broken face, moist; 25 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common coarse, common very fine, and few very fine roots; many very fine interstitial pores; 10 percent clay films on all faces of peds; 15 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; moderately acid, pH 6.1 by pH meter 1:1 water; clear smooth boundary.

Bt2—28 to 37 inches (70 to 95 centimeters); brown (7.5YR 4/2), broken face, gravelly loam, dark brown (7.5YR 3/2), broken face, moist; 25 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and common very fine roots; many very fine interstitial pores; 20 percent clay films on all faces of peds; 25 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; moderately acid, pH 5.9 by pH meter 1:1 water; clear smooth boundary.

BC1—37 to 51 inches (95 to 130 centimeters); brown (7.5YR 4/3), broken face, gravelly loam, dark brown (7.5YR 3/2), broken face, moist; 22 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few very fine roots; many very fine interstitial pores; 25 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; moderately acid, pH 5.8 by pH meter 1:1 water; abrupt smooth boundary.

BC2—51 to 57 inches (130 to 145 centimeters); brown (7.5YR 4/3), broken face, very gravelly loam, dark brown (7.5YR 3/2), broken face, moist; 18 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine interstitial pores; 35 percent subangular strongly cemented 20- to 75-millimeter mixed rock fragments; moderately acid, pH 5.7 by pH meter 1:1 water; abrupt smooth boundary.

Cr—57 to 58 inches (145 to 148 centimeters); strongly cemented, highly fractured greenstone; fractures are 2 to 5 centimeters in size.

Range in Characteristics

These soils are usually dry in all parts of the soil moisture control section between the beginning of June and the middle of November. They have a xeric moisture regime. Base saturation averages 25 to 75 percent in the A and Bt horizons by sum of cations method.

In the control section, rock fragments range from 5 to 35 percent and are mostly gravel and cobbles. Pararock fragments range from 0 to 50 percent and are mostly gravel and cobbles. Clay content averages 20 to 35 percent. Depth to the Cr layer ranges from 100 to more than 150 centimeters.

The A horizons have hue of 10YR or 7.5YR, value of 3, 4, or 5 dry (2.5 or 3 moist), and chroma of 3 dry (2 or 3 moist). Texture of the fine-earth fraction is sandy loam, loam, or sandy clay loam. Clay content ranges from 15 to 26 percent. Rock fragments range from 5 to 35 percent. Reaction ranges from pH 5.8 to 7.1.

The Bt horizons have hue of 10YR or 7.5YR, value of 3, 4, or 5 dry (2.5, 3, or 4 moist), and chroma of 3, 4, or 6 dry (3, 4, or 6 moist). Texture of the fine-earth fraction is loam, sandy clay loam, or clay loam. Clay content ranges from 19 to 35 percent. Rock fragments range from 5 to 35 percent and are mostly gravel. Reaction ranges from pH 5.8 to 7.1.

The BC and C horizons have hue of 10YR or 7.5YR, value of 4 or 5 dry (3 or 4 moist), and chroma of 3 or 6 (dry and moist). Texture of the fine-earth fraction is sandy loam, sandy clay loam, or clay loam. Clay content ranges from 18 to 30 percent. Rock fragments range from 15 to 60 percent and are mostly gravel. Reaction ranges from pH 5.8 to 6.8.

Newpark Series

The Newpark series consists of very deep, moderately well drained soils that formed in alluvium from mixed rock sources (fig. 62). Newpark soils are on alluvial fans. Slopes range from 0 to 2 percent. The mean annual precipitation is about 13 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-silty, mixed, superactive, thermic Calcic Pachic Haploxerolls.

Typical Pedon

Newpark silty clay loam, 0 to 2 percent slopes; Santa Clara County, California; the City of San Jose, Lester Park Property on Chynoweth Road, 200 meters north of Chynoweth Road and 100 meters west of farm buildings, on a west-facing 1 percent slope in a disked field, in a nonsectionized area of T. 8 S., R. 1 E.; at an elevation of 165 feet (50 meters); UTM Zone 10, Northing 4124478, Easting 0603280, NAD83; USGS quadrangle: San Jose East, California. When described, the soil was slightly moist below a depth of 8 inches. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 8 inches (0 to 20 centimeters); grayish brown (10YR 5/2), broken face, silty clay loam, very dark brown (10YR 2/2), broken face, moist; 30 percent clay; moderate medium subangular blocky structure; moderately hard, friable, very sticky and moderately plastic; few very fine roots; common fine tubular pores; neutral, pH 6.9 by pH meter 1:1 water; abrupt smooth boundary. (0 to 20 centimeters thick)

A1—8 to 18 inches (20 to 45 centimeters); grayish brown (10YR 5/2), broken face, silty clay loam, very dark brown (10YR 2/2), broken face, moist; 32 percent clay; strong medium subangular blocky structure; moderately hard, friable, very sticky and moderately plastic; common fine tubular pores; neutral, pH 7.3 by pH meter 1:1 water; clear smooth boundary. (16 to 35 centimeters thick)

A2—18 to 27 inches (45 to 68 centimeters); dark grayish brown (10YR 4/2), broken face, silty clay loam, very dark brown (10YR 2/2), broken face, moist; 32 percent clay; strong medium subangular blocky structure; moderately hard, friable, very sticky and moderately plastic; common fine and common very fine tubular pores; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary. (10 to 50 centimeters thick)

Ck1—27 to 36 inches (68 to 91 centimeters); pale brown (10YR 6/3), broken face, silty clay loam, brown (10YR 4/3), broken face, moist; 28 percent clay; moderate medium subangular blocky structure; moderately hard, friable, very sticky and moderately plastic; common very fine tubular pores; strong effervescence; slightly

Figure 62.—Representative profile of the Newpark series. It is located in a cultivated field of the Lester Park Property in south San Jose. The A horizon is grayish brown silty clay loam to a depth of 68 centimeters. The Ck horizon, which has an accumulation of carbonates, is pale brown and occurs at a depth of 68 to 132 centimeters. The pale brown C horizon starts at depths of 132 centimeters and extends to the bottom of the profile visible in the photo. Newpark soils had a high water table before drainage; they also had an accumulation of soluble salts that were mostly removed by irrigation during decades of farming before urbanization. They are excellent for growing plants.

alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary. (23 to 56 centimeters thick)

Ck2—36 to 52 inches (91 to 132 centimeters); pale brown (10YR 6/3), broken face, silty clay loam, brown (10YR 4/3), broken face, moist; 28 percent clay; moderate medium subangular blocky structure; slightly hard, friable, very sticky and moderately plastic; common very fine tubular pores; 5 percent fine carbonate masses; strong effervescence; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary. (20 to 41 centimeters thick)

C1—52 to 63 inches (132 to 160 centimeters); pale brown (10YR 6/3), broken face, fine sandy loam, brown (10YR 4/3), broken face, moist; 15 percent clay; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine tubular pores; 5 percent fine carbonate masses; slight effervescence; moderately alkaline, pH 7.9 by pH meter 1:1 water; abrupt smooth boundary. (0 to 28 centimeters thick)

C2—63 to 79 inches (160 to 200 centimeters); pale brown (10YR 6/3), broken face, very fine sandy loam, brown (10YR 4/3), broken face, moist; 16 percent clay; weak medium subangular blocky structure; moderately hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; 30 percent dark yellowish brown (10YR 4/4), moist, and light yellowish brown (10YR 6/4), dry, masses of oxidized iron; 5 percent fine carbonate masses; slight effervescence; slightly alkaline, pH 7.8 by pH meter 1:1 water.

Range in Characteristics

Depth to free carbonates and a calcareous matrix is 50 to 95 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The particle-size control section averages 27 to 35 percent clay and 0 to 5 percent rock fragments. Mineralogy is mixed. Organic matter content ranges from 1 to 3 percent to a depth of 8 inches. Historic overdrafting of the ground water of the Santa Clara Valley has drained Newpark soils of water in the lower part of their profile, and the soils are considered partially drained today. Historically, Newpark soils were saline in the natural state; decades of irrigation and lowering of water tables have reclaimed these soils. Electrical conductivity now ranges from 1 to 3 dS/m.

The A horizons have dry color of 10YR 5/2, 4/2, 4/1, 3/2, or 3/1 and moist color of 10YR 3/2, 2/2, or 2/1. Texture is loam, clay loam, or silty clay loam. Clay content ranges from 27 to 35 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 6.6 to 7.8.

The Ck horizons have dry color of 10YR 7/4, 7/3, or 6/3 or 2.5Y 7/1, 6/3, or 5/2 and moist color of 10YR 5/4, 4/4, or 4/3 or 2.5Y 5/3, 5/2, or 4/2. Texture is clay loam or silty clay loam. Clay content ranges from 27 to 35 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 7.8 to 8.4. Carbonate soft masses occur throughout the horizon, and effervescence ranges from slight to violent.

The C horizons have dry color of 10YR 8/4, 6/4, or 6/3 or 2.5Y 7/3 or 6/3 and moist color of 10YR 5/4, 4/4, or 4/3 or 2.5Y 5/2 or 4/3. Texture is fine sandy loam, very fine sandy loam, sandy clay loam, or silty clay loam. Clay content ranges from 15 to 30 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 7.8 to 8.4.

Nisene Series

The Nisene series consists of deep, well drained soils that formed in material weathered from fine grained sandstone and shale. Nisene soils are on uplands and have slopes of 15 to 75 percent. The mean annual precipitation is about 48 inches, and the mean annual air temperature is about 55 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls

Typical Pedon

Nisene loam; Santa Cruz County, California; 7,000 feet due east of the intersection of Olive Springs Road and Hinckley Creek Road on Hinckley Creek Road, in a forested area, in SW1/4 SE1/4 of section 18 (projected), T. 10 S., R.1 W.; lat. 37 degrees 3 minutes 18 seconds N. and long. 121 degrees 54 minutes 4 seconds W.; USGS quadrangle: Laurel, California. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 2 inches (0 to 5 centimeters); variably decomposed mat of leaves, needles, and twigs.

A—2 to 10 inches (5 to 25 centimeters); dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; strong medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and many medium and coarse roots; many fine and medium interstitial and tubular pores; neutral (pH 6.6); clear wavy boundary. (9 to 14 inches thick)

Bt1—10 to 22 inches (25 to 56 centimeters); brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common fine and many medium and coarse roots; many fine, common medium, and many coarse tubular pores and common fine interstitial pores; common thin clay films on faces of peds and few thin clay films lining pores; estimated 10 percent, by volume, angular gravel; slightly acid (pH 6.3); gradual wavy boundary. (10 to 16 inches thick)

Bt2—22 to 32 inches (56 to 81 centimeters); brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common fine and many medium and coarse roots; common fine and many medium and coarse tubular pores; common thin clay films on faces of peds and few thin clay films lining pores; estimated 10 percent angular gravel, about one-half crushing under hand pressure; slightly acid (pH 6.1); gradual wavy boundary. (9 to 14 inches thick)

Bt3—32 to 48 inches (81 to 122 centimeters); brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common fine and many medium and coarse roots; common fine and many medium and coarse tubular pores; few thin clay films lining pores and common thin clay films on faces of peds; estimated 10 percent angular gravel, most crushing under hand pressure; slightly acid (pH 6.1); diffuse irregular boundary. (12 to 18 inches thick)

Bt4—48 to 58 inches (122 to 147 centimeters); yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4), rubbed, moist; weak and moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and common medium and coarse roots; few fine tubular and common very fine interstitial pores; common thin clay films as bridges between mineral grains; estimated 15 percent gravel, most crushing under hand pressure; slightly acid (pH 6.1); clear irregular boundary. (0 to 10 inches thick)

Cr—58 inches (147 centimeters); highly weathered fine grained sandstone; slightly acid (pH 6.1).

Range in Characteristics

Depth to a paralithic contact of soft, fine grained sandstone or shale is 40 to 60 inches. The soil between depths of 6 and 17 inches is typically moist between the end of December and the end of April. The mean annual soil temperature is about 56 to 58 degrees F. Organic matter content is more than 1 percent at a depth of 22 to 34 inches. Base saturation is more than 50 percent in all parts and less than 75 percent in

some or all parts of the profile to a depth of 30 inches. Rock fragments range from 0 to 15 percent, by volume, gravel.

The A horizon is very dark gray, very dark grayish brown, dark gray, dark grayish brown, or grayish brown (10YR 3/1, 3/2, 4/1, 4/2, or 5/2). Texture is sandy loam, fine sandy loam, or loam. This horizon is slightly acid or neutral.

The Bt horizons are dark brown, grayish brown, or brown (10YR 4/3, 5/2, or 5/3 or 7.5YR 5/2) and in some pedons, below a depth of 20 inches, light brownish gray, light yellowish brown, or light brown (10YR 6/2 or 6/4 or 7.5YR 6/4). They are sandy clay loam or clay loam and have 20 to 35 percent clay. They are moderately acid or slightly acid. In some pedons, the Bt3 horizon is yellowish brown or light yellowish brown (10YR 5/4 or 6/4) and is loam or sandy clay loam.

Some pedons have a C horizon that is 5 to 10 inches thick and light yellowish brown or very pale brown (10YR 6/4 or 7/4). This horizon is loam or sandy clay loam.

Novato Series

The Novato series consists of very deep, very poorly drained soils that formed in alluvium from mixed rock sources. Novato soils are in tidally flooded saline marshes and estuaries (figs. 63, 64, and 65). Slopes range from 0 to 1 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 58 degrees F.

Taxonomic Classification

Fine, mixed, superactive, nonacid, mesic Typic Sulfaquents

Figure 63.—Landscape of Novato soils. Photo was taken at the Palo Alto Baylands Nature Preserve. These marsh soils are tidally flooded and occur extensively around the south end of the San Francisco Bay. Bay waters and saturation keep these soils in the mesic soil temperature regime, with average soil temperatures of about 56 degrees F.

Figure 64.—Landscape of Novato, excessively saline soils. Novato soils in these areas of historic salt ponds were used to accumulate sea salt for salt production. Soil salinity is several times higher than in the tidally flooded Novato soils. Novato soils in these areas have never been drained and are saturated to the surface but have controlled flooding.

Typical Pedon

Novato clay, 0 to 1 percent slopes, tidally flooded; Santa Clara County, California; Palo Alto Baylands Nature Preserve, first parking area past the gate on the road to park headquarters, south past the nature sign into marsh, about 50 feet southeast, in a level area of marsh under a cover of pickleweed, in a nonsectionized area of T. 5 S., R. 2 W.; at an elevation of 0 meters; UTM Zone 10, Northing 4145748, Easting 0578863, NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was saturated throughout. (Colors are for wet soil unless otherwise noted.)

Anzg1—0 to 4 inches (0 to 9 centimeters); gray (2.5Y 6/1), exterior, clay, very dark gray (5Y 3/1), exterior, moist; 66 percent clay; massive; hard, very friable, moderately sticky and moderately plastic; many fine roots; few fine tubular pores; moderately alkaline, pH 8.1 by pH meter 1:1 water; abrupt smooth boundary.

Anzg2—4 to 11 inches (9 to 29 centimeters); light olive brown (2.5Y 5/3), exterior, clay, 40 percent dark greenish gray (10Y 4/1), exterior, moist and 60 percent dark greenish gray (5GY 4/1), exterior, moist; 65 percent clay; massive; hard, very friable, moderately sticky and moderately plastic; many medium roots; moderately alkaline, pH 8.0 by pH meter 1:1 water; abrupt smooth boundary.

Cnzg1—11 to 24 inches (29 to 60 centimeters); greenish gray (10Y 5/1), exterior, clay, greenish black (5G 2.5/1), exterior, moist; 64 percent clay; massive; hard, very friable, very sticky and moderately plastic; moderately alkaline, pH 8.2 by pH meter 1:1 water; clear smooth boundary.

Cnzg2—24 to 39 inches (60 to 100 centimeters); greenish gray (10Y 6/1), exterior, clay, greenish black (5G 2.5/1), exterior, moist; 65 percent clay; massive; hard,

Figure 65.—Novato soils used as levees are acid sulphate soils because of excavation and drying. They have become extremely acid, killing plants and polluting the surrounding area with acid runoff. Soil pH is typically between 3.5 and 4.0.

very friable, very sticky and moderately plastic; moderately alkaline, pH 8.3 by pH meter 1:1 water; clear smooth boundary.

Cnzg3—39 to 59 inches (100 to 150 centimeters); greenish gray (10Y 6/1), exterior, clay, dark greenish gray (5G 3/1), exterior, moist; 63 percent clay; massive; hard, very friable, very sticky and moderately plastic; moderately alkaline, pH 8.2 by pH meter 1:1 water.

Range in Characteristics

Tidal flooding covers these soils daily throughout the year unless protected by levees. Depth to water table at low tide is as little as 50 centimeters but the water table may be near the surface. The mean annual soil temperature is 55 to 58 degrees F; it fluctuates from 50 degrees F in winter to 65 degrees F in summer. The soil temperature parallels the water temperature in the south part of the San Francisco Bay. The soil moisture control section is saturated in all parts year-round. The particle-size control section averages 35 to 70 percent clay.

These soils are potentially acid sulphate, containing sulphides that will convert to sulphuric acid upon oxidation and thus lower soil pH to between 3 and 4. Soil stability is very low with N values less than 1; these soils are highly compressible. Electrical conductivity ranges from 35 to 75 dS/m. Exchangeable sodium ratio ranges from 60 to 75. Mineralogy is mixed. Organic matter content ranges from 1 to 5 percent to a depth of 150 centimeters.

The Anzg horizons have dry color of 10YR 6/3; 5Y 5/1; or 2.5Y 6/1, 5/3, 5/1, or 4/1. They have moist color of 10YR 3/2, 10Y 4/1, 5GY 4/1, 5Y 3/1, or 2.5Y 3/1. Texture is silty clay loam, silty clay, or clay. Clay content ranges from 30 to 70 percent.

Redoximorphic features have dry color of 10YR 5/6 or 2.5Y 5/0 and moist color of 10YR 3/6 or 3/4 and make up 5 to 40 percent of the horizon. Reaction ranges from pH 6.3 to 9.0.

The Cnzg1 horizon has dry color of 10YR 5/1; 10Y 5/1; 5Y 5/1; or 2.5Y 6/4, 6/1, 5/2, or 5/1. It has moist color of 10YR 3/1; 5Y 3/1; 5G 2.5/1; or 2.5Y 4/1, 3/2, or 3/1. Texture is silty clay loam, clay loam, silty clay, or clay. Clay content ranges from 35 to 70 percent. Redoximorphic features have dry color of 10YR 5/6 or 2.5Y 5/2 and moist color of 10YR 3/4 or 2.5Y 3/2 and make up 10 to 30 percent of the horizon. Reaction ranges from pH 6.3 to 9.0.

The Cnzg2 horizon has dry color of 10YR 5/1; 10Y 6/1; 5Y 5/1; or 2.5Y 6/2, 5/1, or 4/2. It has moist color of 10YR 3/1; 5Y 3/1; 5G 2.5/1; or 2.5Y 4/3, 3/2, or 3/1. Texture is clay loam, silty clay, or clay. Clay content ranges from 35 to 70 percent. Redoximorphic features have dry color of 2.5Y 5/4 or 4/1 and moist color of 2.5Y 3/2 or 2.5/1 and make up 10 to 20 percent of the horizon. Reaction ranges from pH 6.3 to 9.0.

The Cnzg3 horizon has dry color of 10Y 6/1; 5Y 5/1; or 2.5Y 6/3, 5/2, or 4/2. It has moist color of 5Y 3/1; 5G 3/1; or 2.5Y 4/3, 4/2, or 3/2. Texture is clay loam, silty clay, or clay. Clay content ranges from 35 to 70 percent. Redoximorphic features have dry color of 2.5Y 5/1 or N 5/0 and moist color of 2.5Y 4/1 or N 3/0 and make up 10 to 20 percent of the horizon. Reaction ranges from pH 6.3 to 9.0.

Pachic Argixerolls

Pachic Argixerolls consist of deep, well drained soils that formed in residuum weathered from calcareous sandstone. These soils are on terraces and hills. Slopes range from 2 to 30 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Argixerolls

Typical Pedon

Pachic Argixerolls loam; Santa Clara County, California; Rancho San Antonio Open Space, west of the main parking across the creek and south on a ridge, on a north-facing 8 percent slope; at an elevation of 410 feet; USGS quadrangle: Cupertino, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Pachic Argixerolls in this survey area because of the highly variable nature of these soils.

Oi—0 to 2 inches (0 to 4 centimeters); slightly decomposed plant material; abrupt smooth boundary.

Oe—2 to 2 inches (4 to 5 centimeters); moderately decomposed plant material; abrupt smooth boundary.

A—2 to 5 inches (5 to 13 centimeters); brown (10YR 4/3), broken face, loam, dark brown (10YR 3/3), broken face, moist; 21 percent clay; strong fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately acid, pH 5.8 by pH meter 1:1 water; clear smooth boundary.

Bt1—5 to 9 inches (13 to 24 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent clay films on all faces of peds; moderately acid, pH 5.7 by pH meter 1:1 water; clear smooth boundary.

Bt2—9 to 26 inches (24 to 65 centimeters); brown (10YR 5/3), broken face, sandy clay loam, brown (10YR 4/3), broken face, moist; 32 percent clay; strong medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic;

80 percent clay films on all faces of peds; slightly acid, pH 6.2 by pH meter 1:1 water; clear smooth boundary.

Bt3—26 to 47 inches (65 to 120 centimeters); yellowish brown (10YR 5/4), broken face, sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 30 percent clay; strong medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; 50 percent clay films on all faces of peds; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear smooth boundary.

Bw—47 to 59 inches (120 to 150 centimeters); dark yellowish brown (10YR 4/4), broken face, sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 27 percent clay; strong medium subangular blocky structure; hard, firm, moderately sticky and moderately plastic; slightly alkaline, pH 7.7 by pH meter 1:1 water.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is more than 60 inches. The mean annual soil temperature is 59 to 72 degrees F. The particle-size control section averages 23 to 32 percent clay.

The A horizon has dry color of 10YR 4/3 and moist color of 10YR 3/3. Texture is loam. Clay content ranges from 20 to 25 percent. Reaction is moderately acid.

The Bt horizon has dry color of 10YR 5/3 or 5/4 and moist color of 10YR 3/3 or 4/3. Texture is sandy clay loam. Clay content ranges from 23 to 32 percent. Reaction ranges from slightly acid (pH 6.2) to slightly alkaline (pH 7.4)

Pachic Haploxerolls, Loamy-Skeletal

Pachic Haploxerolls, loamy-skeletal consist of deep, well drained soils that formed in alluvium derived from metamorphic and sedimentary rock. These soils are on alluvial fans. Slopes range from 0 to 30 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, thermic Typic Haploxerolls (Note: Some pedons are in the loamy-skeletal, mixed, active, thermic family.)

Typical Pedon

Pachic Haploxerolls, loamy-skeletal; Santa Clara County, California; Los Altos, Heritage Oaks Park, in an old orchard between the stream and parking lot, on a west-facing 1 percent slope; at an elevation of 200 feet; UTM Zone 10, Northing 4134992, Easting 580907, NAD83; USGS quadrangle: Mountain View, California. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Pachic Haploxerolls, loamy-skeletal in this survey area because of the highly variable nature of these soils.

Ap—0 to 2 inches (0 to 5 centimeters); brown (10YR 5/3), broken face, gravelly sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 16 percent clay; weak fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; common very fine roots; many very fine irregular and common very fine tubular pores; 15 percent subrounded 2- to 75-millimeter rock fragments; very slight effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6 by pH meter 1:1 water; clear smooth boundary.

A—2 to 14 inches (5 to 36 centimeters); brown (7.5YR 5/3), broken face, very gravelly sandy clay loam, dark brown (7.5YR 3/2), broken face, moist; 20 percent clay; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine roots; common fine irregular and many very fine irregular pores;

35 percent subrounded 2- to 75-millimeter rock fragments; moderately alkaline, pH 7.9 by pH meter 1:1 water; clear smooth boundary.

Bw—14 to 31 inches (36 to 80 centimeters); brown (7.5YR 5/4), broken face, very gravelly coarse sandy loam, dark brown (7.5YR 3/3), broken face, moist; 18 percent clay; weak fine subangular blocky structure; hard, firm, slightly sticky and nonplastic; common very fine roots; many very fine irregular pores; 45 percent subrounded 2- to 75-millimeter rock fragments; slightly alkaline, pH 7.5 by pH meter 1:1 water; abrupt smooth boundary.

C1—31 to 47 inches (80 to 120 centimeters); light brown (7.5YR 6/4), broken face, extremely gravelly loamy coarse sand, dark brown (7.5YR 3/4), broken face, moist; 5 percent clay; massive; loose, loose, nonsticky and nonplastic; few medium roots; many fine irregular pores; 65 percent subrounded 2- to 75-millimeter rock fragments; neutral, pH 6.7 by pH meter 1:1 water; gradual smooth boundary.

C2—47 to 59 inches (120 to 150 centimeters); light brown (7.5YR 6/4), broken face, very gravelly loamy coarse sand, dark brown (7.5YR 3/4), broken face, moist; 5 percent clay; massive; loose, loose, nonsticky and nonplastic; few very fine roots; many fine irregular pores; 45 percent nonflat subrounded 2- to 75-millimeter rock fragments; slightly acid, pH 6.5 by pH meter 1:1 water.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is more than 60 inches. The mean annual soil temperature is 59 to 72 degrees F.

The A horizon has dry color of 10YR 5/3 and moist color of 10YR 3/2. Texture is gravelly sandy loam, very gravelly sandy loam, or sandy clay loam. Clay content ranges from 16 to 20 percent. Rock fragments range from 15 to 35 percent and are 2 to 75 millimeters in size. Reaction is moderately alkaline or strongly alkaline.

The B horizon has dry color of 7.5YR 5/4 and moist color of 7.5YR 3/3. Texture is very gravelly coarse sandy loam. Clay content ranges from 15 to 20 percent. Rock fragments range from 35 to 50 percent and are 2 to 75 millimeters in size. Reaction is slightly alkaline.

The C horizon has dry color of 7.5YR 6/4 and moist color of 7.5YR 3/4. Texture is very gravelly or extremely gravelly loamy coarse sand. Clay content is about 5 percent. Rock fragments range from 45 to 65 percent and are 2 to 75 millimeters in size. Reaction is slightly acid or neutral.

Pachic Ultic Haploxerolls

Pachic Ultic Haploxerolls consist of deep, moderately well drained soils that formed in residuum weathered from conglomerate. These soils are on mountains. Slopes range from 15 to 30 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Pachic Ultic Haploxerolls

Typical Pedon

Pachic Ultic Haploxerolls; Santa Clara County, California; Monte Bello Open Space, south of the main parking area south of Page Mill Road, in a slide area just above a sag area with seasonal wetness, on a south-facing 20 percent slope; at an elevation of 2,100 feet; UTM Zone 10, Northing 4131093.00, Easting 572835.00, NAD83; USGS quadrangle: Mindego Hill, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not

completely typical of the Pachic Ultic Haploxerolls in this survey area because of the highly variable nature of these soils.

Oi—0 to 1 inch (0 to 2 centimeters); moderately decomposed plant material; abrupt smooth boundary.

A1—1 to 6 inches (2 to 16 centimeters); brown (10YR 5/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 16 percent clay; strong medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine tubular and common very fine interstitial pores; 35 percent subrounded very strongly cemented 2- to 75-millimeter mixed rock fragments; moderately acid, pH 5.8 by pH meter 1:1 water; clear smooth boundary.

A2—6 to 16 inches (16 to 40 centimeters); brown (10YR 5/3), broken face, very gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 22 percent clay; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine interstitial and common very fine tubular pores; 35 percent subrounded very strongly cemented 2- to 75-millimeter mixed rock fragments; moderately acid, pH 5.7 by pH meter 1:1 water; clear smooth boundary.

A/B—16 to 43 inches (40 to 110 centimeters); brown (10YR 4/3), broken face, gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 25 percent clay; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine tubular and common very fine interstitial pores; 20 percent subrounded very strongly cemented 2- to 75-millimeter mixed rock fragments; moderately acid, pH 5.9 by pH meter 1:1 water; clear smooth boundary.

Bt—43 to 59 inches (110 to 150 centimeters); brown (10YR 5/3), broken face, gravelly sandy clay loam, brown (10YR 4/3), broken face, moist; 29 percent clay; strong medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine tubular and common very fine interstitial pores; 5 percent clay films on all faces of peds; 20 percent subrounded very strongly cemented 2- to 75-millimeter mixed rock fragments; moderately acid, pH 6.1 by pH meter 1:1 water.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is more than 60 inches. The mean annual soil temperature is 46 to 59 degrees F. The particle-size control section averages 20 to 30 percent clay and 20 to 35 percent rock fragments, mostly gravel.

The A horizon has dry color of 10YR 5/3 and moist color of 10YR 3/3. Texture is gravelly sandy loam or sandy clay loam. Clay content ranges from 15 to 25 percent. Rock fragments range from 30 to 40 percent and are 2 to 75 millimeters in size. Reaction is moderately acid.

The B horizon has dry color of 10YR 4/3 or 5/3 and moist color of 4/3 or 3/3. Texture is gravelly sandy clay loam. Clay content ranges from 20 to 30 percent. Rock fragments range from 15 to 25 percent and are 2 to 75 millimeters in size. Reaction is moderately acid.

Pleasanton Series

The Pleasanton series consists of deep, well drained soils that formed from mixed rock sources. Pleasanton soils are on nearly level or gently sloping alluvial fans and terraces. Slopes range from 0 to 5 percent. The mean annual precipitation is about 13 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Mollic Haploxeralfs

Typical Pedon

Pleasanton gravelly fine sandy loam; Alameda County, California; about 5 miles southeast of the center of Livermore, in a cultivated area, in SE1/4 NE1/4 NE1/4 of section 24, T. 3 S., R. 2 E.; lat. 37 degrees 39 minutes 45 seconds N. and long. 121 degrees 41 minutes 48 seconds W.; USGS quadrangle: Altamont, California. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 9 inches; grayish brown (10YR 5/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; common very fine and fine interstitial pores; slightly acid (pH 6.3); abrupt smooth boundary. (5 to 10 inches thick)

A—9 to 21 inches; grayish brown (10YR 5/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; common very fine and fine interstitial pores; neutral (pH 6.8); clear smooth boundary. (10 to 14 inches thick)

Bt1—21 to 48 inches; brown (10YR 4/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; common very fine and fine roots; many very fine and fine and few medium tubular pores; common moderately thick clay films on peds and in pores; neutral (pH 7.3); gradual wavy boundary. (12 to 32 inches thick)

Bt2—48 to 64 inches; brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine and common fine pores; few thick and few thin clay films on peds and in pores; neutral (pH 7.3); gradual wavy boundary. (8 to 20 inches thick)

C—64 to 72 inches; yellowish brown (10YR 5/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak blocky structure; hard, friable, sticky and slightly plastic; many very fine, common fine, and few medium pores; few thin clay films on peds and in pores; slightly alkaline (pH 7.4).

Range in Characteristics

Solum thickness to the bottom of the B horizon is 60 inches. The soils become moist in November or early December and remain moist until May. The mean annual temperature is about 59 to 64 degrees F.

The A horizon is dark grayish brown, grayish brown, or brown with hue of 10YR or 7.5YR. It is moderately acid to neutral (pH 6.0 to 7.0).

The B horizon is brown to light yellowish brown with hue of 10YR or 7.5YR. It is loam, sandy clay loam, or clay loam and is gravelly or cobbly in some pedons. It ranges from slightly acid to slightly alkaline.

The C horizon is gravelly fine sandy loam, gravelly loam, or loam. It is neutral or mildly alkaline and is slightly calcareous in some pedons.

Sanikara Series

The Sanikara series consists of well drained soils that are very shallow and shallow to a lithic contact and that formed in residuum weathered from sandstone (fig. 66). Sanikara soils are on hills, mountain slopes, and summits (fig. 67). Slopes range from 8 to 100 percent. The mean annual precipitation is about 50 inches, and the mean annual air temperature is about 57 degrees F.

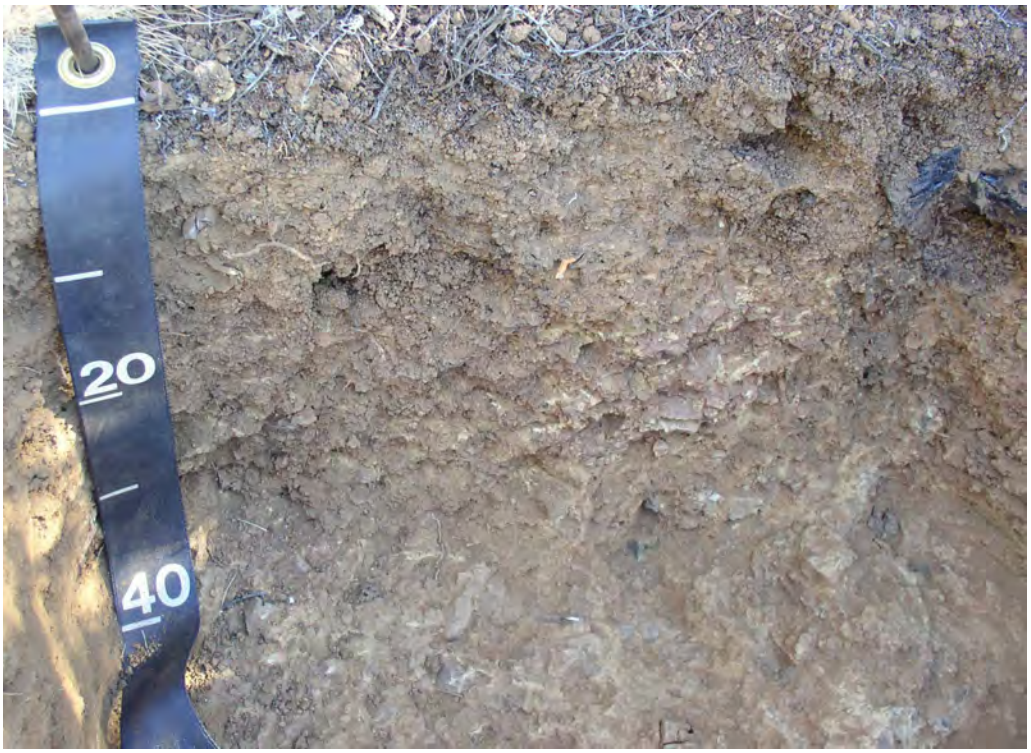


Figure 66.—A sampling location of Sanikara soils. These soils are shallow and contain more than 35 percent coarse fragments. Texture is sandy loam to light clay loam. The bedrock is hard fractured sandstone. These soils are extensive in the Santa Cruz Mountains on the Franciscan Formation east of the San Andreas Fault.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic, Lithic Haploxerolls

Typical Pedon

Sanikara gravelly sandy loam in an area of Katykat-Mouser-Sanikara complex, 30 to 50 percent slopes; Santa Clara County, California; New Almaden Quicksilver County Park, Hacienda entrance, Hacienda Road, just up from road on a grassy south-facing (180 degree) 20 percent slope, in a nonsectionized area of T. 9 S., R. 1 E.; at an elevation of 1,056 feet; UTM Zone 10, Northing 4116092, Easting 602795, NAD83; USGS quadrangle: Santa Teresa Hills, California. When described on April 8, 2008, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 3 centimeters); very dark grayish brown (10YR 3/2), broken face, slightly decomposed plant material, very dark brown (10YR 2/2), broken face, moist; loose, nonsticky and nonplastic; neutral, pH 6.8 by Bromthymol blue; abrupt smooth boundary.

A1—1 to 5 inches (3 to 12 centimeters); brown (10YR 5/3), broken face, gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 18 percent clay; weak fine subangular blocky structure parting to weak very fine granular; moderately hard, friable, nonsticky and nonplastic; many fine, common medium, and many very fine roots; many fine, common medium, and many very fine irregular pores; 30 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; neutral, pH 6.8 by Bromthymol blue; clear smooth boundary.

Figure 67.—Landscape of Sanikara soils. Photo was taken on the Monte Bello Open Space on Monte Bello Ridge, along Waterwheel Creek Trail. These soils are mostly on steep, south and west slopes with a cover of brush and poison oak. Footpath soils with tree and grass cover are in the background.

A2—5 to 12 inches (12 to 31 centimeters); brown (10YR 5/3), broken face, very gravelly sandy loam, dark brown (10YR 3/3), broken face, moist; 20 percent clay; weak fine subangular blocky structure parting to weak very fine granular and weak very fine subangular blocky structure parting to weak very fine granular; moderately hard, friable, nonsticky and nonplastic; many fine, common medium, and many very fine roots; many fine, common medium, and many very fine irregular pores; 50 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.6 by Bromthymol blue; abrupt irregular boundary.

R—12 to 17 inches (31 to 42 centimeters); strongly cemented, fractured sandstone.

Range in Characteristics

These soils are usually moist in some part of the soil moisture control section between the first of November and the end of May. They have a xeric moisture regime. B horizons, if they occur, may have a slightly higher clay content than the A horizon.

In the control section, textures are sandy loam, loam, sandy clay loam, and clay loam. Rock fragments range from 35 to 75 percent and are mostly gravel and cobbles. Clay content averages 18 to 30 percent. Reaction ranges from pH 5.6 to 6.8.

The A horizons have hue of 10YR, value of 4 or 5 dry (2 or 3 moist), and chroma of 3 or 4 dry (2 or 3 moist).

Santerhill Series

The Santerhill series consists of deep, well drained soils that formed in colluvium from ultramafic materials (fig. 68). Santerhill soils are on hills (fig. 69). Slopes range from 9 to 30 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine, magnesic, thermic Aridic Haploxererts

Typical Pedon

Santerhill clay in an area of Montara-Santerhill complex, 15 to 30 percent slopes; Santa Clara County, California; Santa Teresa County Park, south of a group area, west of the restrooms, about halfway to the corral and up on the slope near a large rock, on a northwest-facing 30 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 8 S., R. 2 E.; at an elevation of 590 feet; UTM Zone 10, Northing 4119065, Easting 607531, NAD83; USGS quadrangle: Santa Teresa Hills, California. When described, the soil was dry to a depth of 50 centimeters and slightly moist below. (Colors are for dry soil unless otherwise noted.)

A—0 to 4 inches (0 to 11 centimeters); dark gray (10YR 4/1), broken face, clay, very dark gray (10YR 3/1), broken face, moist; 45 percent clay; strong medium subangular blocky structure; hard, firm, very sticky and very plastic; many very fine roots; few very fine tubular pores; 20 percent clay films on all faces of peds; 5 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt smooth boundary. (11 to 16 centimeters thick)

Bss1—4 to 13 inches (11 to 33 centimeters); dark gray (10YR 4/1), broken face, clay, very dark gray (10YR 3/1), broken face, moist; 45 percent clay; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; few very fine interstitial pores; 10 percent pressure faces on vertical faces of peds; 5 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

Bss2—13 to 24 inches (33 to 62 centimeters); dark gray (10YR 4/1), broken face, clay, very dark gray (10YR 3/1), broken face, moist; 45 percent clay; strong medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine interstitial pores; 5 percent pressure faces on vertical faces of peds; 10 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; neutral, pH 6.9 by pH meter 1:1 water; abrupt smooth boundary.

Bss3—24 to 33 inches (62 to 85 centimeters); gray (2.5Y 5/1), broken face, gravelly clay loam, dark gray (2.5Y 4/1), broken face, moist; 36 percent clay; weak medium subangular blocky structure; hard, firm, very sticky and moderately plastic; few very fine interstitial pores; 60 percent pressure faces on vertical faces of peds; 15 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary. (Combined thickness of the Bss horizons is 59 to 74 centimeters.)

B—33 to 46 inches (85 to 117 centimeters); light olive brown (2.5Y 5/3), broken face, gravelly sandy clay loam, olive brown (2.5Y 4/3), broken face, moist; 32 percent clay; weak medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; few very fine interstitial pores; 50 percent clay films on all faces of peds; 30 percent angular strongly cemented 2- to 75-millimeter

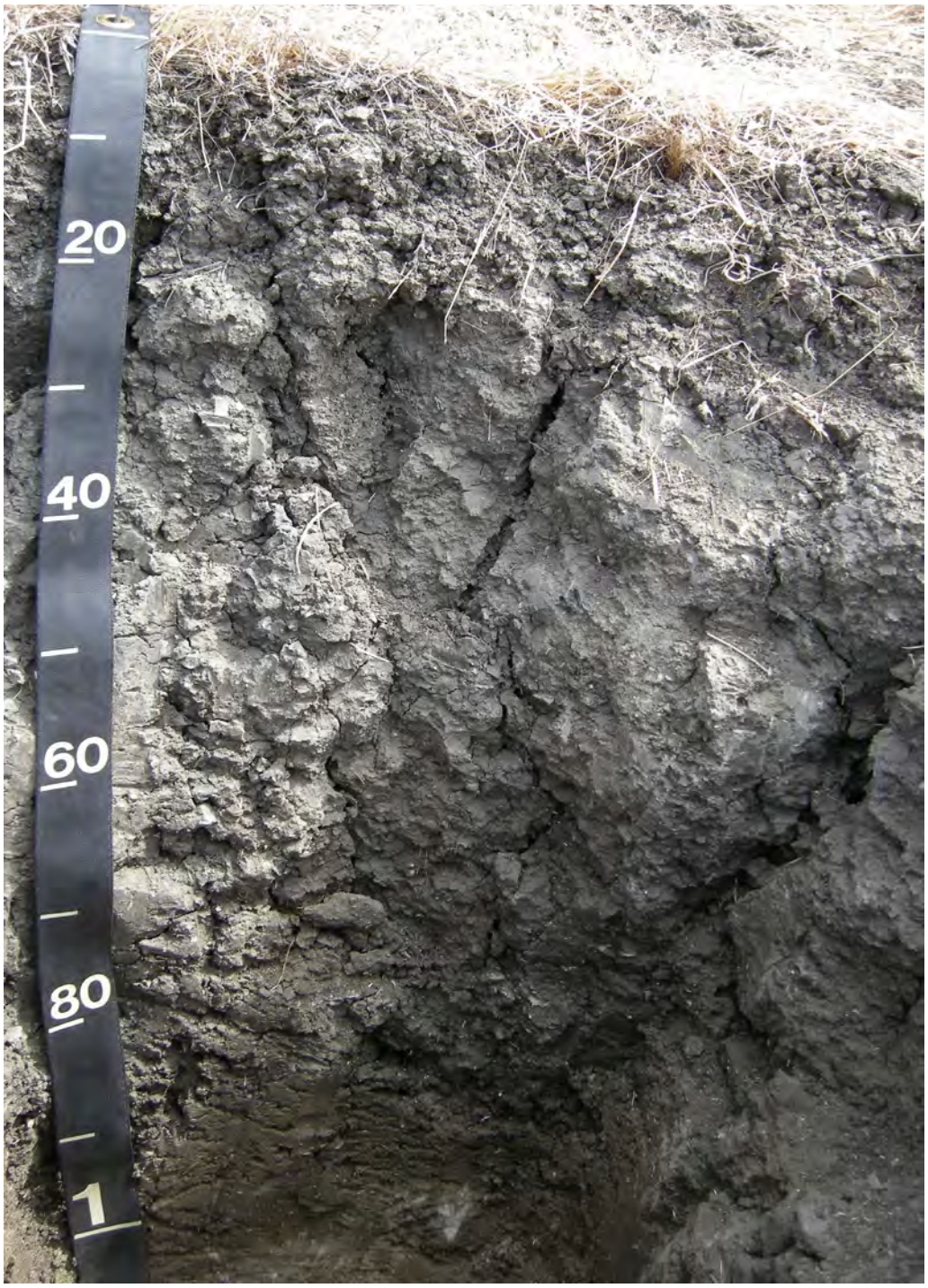


Figure 68.—Representative profile of the Santerhill series. These soils developed from serpentinite and have clay textures. Cracks are visible to a depth of about 1 meter. The cracks will close during the winter. Rock fragment content increases in the lower part of the profile. The paralithic contact of serpentinite is at a depth of 117 centimeters. Santerhill soils have a calcium to magnesium ratio of about 1:10.

Figure 69.—Landscape of Santerhill soils. Photo was taken in Santa Teresa Hills County Park at the type location, near the picnic area. Grass and scattered brush cover these soils that have many stones and cobbles on the surface (some stones are visible in the grass). Cropley soils occur in the valley in the background, and Alo and Altamont soils are on the hills.

serpentinite fragments; moderately alkaline, pH 8.0 by pH meter 1:1 water; abrupt smooth boundary. (30 to 32 centimeters thick)

Cr—46 to 52 inches (117 to 133 centimeters); moderately cemented serpentinite.

Range in Characteristics

Depth to weathered serpentine is 100 to 150 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The particle-size control section averages 35 to 50 percent clay and 5 to 10 percent rock fragments, mostly gravel. Mineralogy is magnesic. The soils are not calcareous. Organic matter content ranges from 2 to 3 percent to a depth of 15 centimeters. Reversible surface-initiated cracks 2 to 4 centimeters wide extend to a depth of 50 centimeters from May to October when the soil is not irrigated. Slickensides range from 10 to 60 percent in the Bss horizon. Rock fragments on the surface range from 2 to 10 percent cobbles and stones.

The A horizon has dry color of 10YR 4/2 or 4/1 or 2.5Y 3/1 and moist color of 10YR 3/2 or 3/1 or 2.5Y 2.5/1. Texture is clay. Clay content ranges from 40 to 50 percent. Rock fragments range from 5 to 10 percent gravel. Reaction ranges from pH 6.6 to 7.3.

The Bss horizon has dry color of 10YR 4/2 or 4/1 or 2.5Y 5/1 and moist color of 10YR 3/2 or 3/1 or 2.5Y 4/1. Texture is clay loam or clay. Clay content ranges from 35 to 50 percent. Rock fragments range from 5 to 10 percent gravel. Reaction ranges from pH 6.6 to 8.2.

The B horizon has dry color of 2.5Y 5/3 or 4/2 and moist color of 2.5Y 4/3 or 3/2. Texture is gravelly sandy clay loam, clay loam, or clay. Clay content ranges from 35 to 50 percent. Rock fragments range from 10 to 30 percent gravel. Reaction ranges from pH 6.6 to 8.2.

Santerhill Taxadjunct

The Santerhill taxadjunct consists of deep, well drained soils that formed in residuum from serpentinite. These soils are on mountains. Slopes range from 8 to 75 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Fine, magnesic, thermic Typic Argixerolls

Typical Pedon

Santerhill taxadjunct in an area of Santerhill-Xerolls-Mouser complex, 15 to 30 percent slopes, mined land; Santa Clara County, California; Almaden Quicksilver County Park, Hildago Cemetery Road, on a southwest-facing 37 percent slope across the road from Hildago Cemetery, under a cover of annual grasses, in a nonsectionized area of T. 9 S., R. 1 E.; at an elevation of 1,358 feet; UTM Zone 10, Northing 4114458, Easting 603327, NAD83; USGS quadrangle: Santa Teresa Hills, California. When described on August 30, 2006, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 5 inches (0 to 12 centimeters); brown (7.5YR 4/3), broken face, clay loam, dark brown (7.5YR 3/3), broken face, moist; 29 percent clay; strong medium and strong coarse subangular blocky structure; hard, moderately sticky and moderately plastic; 5 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.5 by pH meter 1:1 water; abrupt wavy boundary.

Bw1—5 to 12 inches (12 to 30 centimeters); brown (7.5YR 4/4), broken face, clay loam, brown (7.5YR 4/3), broken face, moist; 34 percent clay; massive; hard, very sticky and very plastic; 5 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.5 by pH meter 1:1 water; clear smooth boundary.

Bw2—12 to 24 inches (30 to 60 centimeters); brown (7.5YR 5/4), broken face, clay loam, brown (7.5YR 4/4), broken face, moist; 34 percent clay; hard, very sticky and very plastic; 5 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

C1—24 to 30 inches (60 to 75 centimeters); strong brown (7.5YR 5/6), broken face, gravelly sandy loam, strong brown (7.5YR 4/6), broken face, moist; 18 percent clay; moderately hard, moderately sticky and slightly plastic; 30 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.5 by pH meter 1:1 water; clear smooth boundary.

C2—30 to 39 inches (75 to 100 centimeters); strong brown (7.5YR 5/6), broken face, extremely gravelly coarse sandy loam, strong brown (7.5YR 4/6), broken face, moist; 5 percent clay; slightly hard, nonsticky and nonplastic; 70 percent angular strongly cemented 2- to 75-millimeter serpentinite fragments; slightly acid, pH 6.5 by pH meter 1:1 water; abrupt wavy boundary.

R—39 to 40 inches (100 to 101 centimeters); serpentinite.

Range in Characteristics

Depth to serpentinitic bedrock is 100 to 150 centimeters. The mean annual soil temperature is 55 to 61 degrees F. The soil moisture control section is dry in all parts from about June 1 to November 1 (about 130 days). The particle-size control section averages 30 to 35 percent clay and 5 to 15 percent rock fragments, mostly gravel. Mineralogy is magnesic. The soils are not calcareous. Organic matter content ranges from 3 to 6 percent to a depth of 12 centimeters.

The A horizon has dry color of 7.5YR 4/3 or 5YR 5/4 and moist color of 7.5YR 3/4 or 3/3 or 5YR 3/4. Texture is loam or clay loam. Clay content ranges from 25 to 35

percent. Rock fragments range from 2 to 15 percent gravel. Reaction ranges from pH 6.5 to 7.8.

The Bw horizons have dry color of 10YR 4/4; 7.5YR 4/6, 4/4, or 4/3; or 5YR 4/4 or 3/4. They have moist color of 10YR 4/4; 7.5YR 4/6, 4/4, or 3/4; or 5YR 3/4. Texture is clay loam. Clay content ranges from 30 to 35 percent. Rock fragments range from 2 to 15 percent gravel. Reaction ranges from pH 6.5 to 7.8.

The C horizons have dry color of 10YR 5/4; 7.5YR 6/8 or 5/6; or 5YR 4/6. They have moist color of 10YR 4/4, 7.5YR 5/6, or 5YR 3/4. Texture is gravelly sandy loam or extremely gravelly coarse sandy loam. Clay content ranges from 2 to 22 percent. Rock fragments range from 15 to 70 percent gravel. Reaction ranges from pH 6.5 to 7.8.

These soils are considered a taxadjunct to the Santerhill series because they have a lower clay content and do not have the deep vertical cracking consistent with Vertisols.

Skyridge Series

The Skyridge series consists of shallow, well drained soils that formed in residuum from sandstone (fig. 70). Skyridge soils are on mountains (fig. 71). Slopes range from 8 to 30 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Loamy, mixed, superactive, mesic Lithic Ultic Haploxerolls

Figure 70.—Representative profile of the Skyridge series. These shallow soils occur along ridgetops along Skyline Boulevard. There is very little soil development, only an A horizon over hard sandstone bedrock. Vegetation is oaks and bay laurel. Skyridge soils occur in complex with Casrock soils, which are moderately deep.

Figure 71.—Landscape of Skyridge and Casrock soils. Photo was taken in the Saratoga Gap Open Space along Saratoga Gap Trail along Skyline Boulevard. Rock outcrops occur in many areas. Vegetation is dominantly oaks with some Douglas fir. These soils occur on ridgetops along the eastern boundary of the survey area, along Skyline Boulevard in the Santa Cruz Mountains.

Typical Pedon

Skyridge gravelly fine sandy loam in an area of Casrock-Skyridge-Rock outcrop complex, 8 to 30 percent slopes; Santa Clara County, California; Skyline County Park, along Skyline Boulevard, east of the road at the trailhead and road gate, south on the ridge about 500 feet, on a southwest-facing 18 percent slope under a cover of Douglas fir, California bay laurel, and oaks, in section 22 T. 8 S., R. 2 W.; at an elevation of 879 meters; UTM Zone 10, Northing 4119595, Easting 582175, NAD83; USGS quadrangle: Castle Rock Ridge, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 1 inch (0 to 3 centimeters); very dark grayish brown (10YR 3/2), rubbed, slightly decomposed plant material consisting of decaying needles, leaves, and twigs, very dark brown (10YR 2/2), rubbed, moist; rubbed fiber content of 20 percent; abrupt smooth boundary.

A—1 to 10 inches (3 to 25 centimeters); dark grayish brown (10YR 4/2), broken face, gravelly fine sandy loam, very dark brown (10YR 2/2), broken face, moist; 12 percent clay; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common fine and few medium roots; many very fine interstitial pores; 5 percent subangular strongly cemented 75- to 210-millimeter sandstone fragments and 25 percent subangular strongly cemented 2- to 75-millimeter sandstone fragments; pH 6.4 by pH meter 1:1 water; abrupt wavy boundary.

R—10 to 11 inches (25 to 28 centimeters); hard, coarse grained, unfractured sandstone; strongly cemented.

Range in Characteristics

Depth to hard sandstone is 20 to 50 centimeters. The mean annual soil temperature is 55 to 59 degrees F. The particle-size control section averages 10 to 18 percent clay, 5 to 35 percent gravel, and 0 to 5 percent cobbles. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 2 to 5 percent to a depth of 25 centimeters. Base saturation by sum of cations ranges from 35 to 75 percent to a depth of 25 centimeters. Rock fragments on the surface range from 0 to 20 percent stones and 0 to 20 percent boulders.

The A horizon has dry color of 10YR 5/3, 5/2, or 4/2 and moist color of 10YR 3/3, 3/2, or 2/2. Texture is fine sandy loam or sandy loam or their gravelly analogs. Clay content ranges from 10 to 18 percent. Rock fragments range from 5 to 35 percent gravel and 0 to 5 percent cobbles. Reaction ranges from pH 4.1 to 6.2.

Stevenscreek Series

The Stevenscreek series consists of very deep, well drained soils that formed in material developed from alluvium (fig. 72). Stevenscreek soils are on alluvial fans (fig. 73). Slopes range from 0 to 9 percent. The mean annual precipitation is about 15 inches, and the mean annual temperature is about 58 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Pachic Haploxerolls

Typical Pedon

Stevenscreek sandy loam in an area of Urban land-Stevenscreek complex, 0 to 2 percent slopes; Santa Clara County, California; Eagle Park, City of Mountain View, on the northeast side of a grass field across the fence from Shoreline Boulevard, on a north-facing 2 percent slope under a cover of turf grass, in section 21, T. 6 S., R. 2 W.; at an elevation of 52 feet; UTM Zone 10, Northing 4138486, Easting 0580825, NAD83; USGS quadrangle: Mountain View, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 2 inches (0 to 5 centimeters); very dark grayish brown (10YR 3/2), broken face, sandy loam, very dark brown (10YR 2/2), broken face, moist; 17 percent clay; strong fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; common fine and common very fine roots; many very fine interstitial pores; strongly acid, pH 5.4 by pH meter 1:1 water; clear smooth boundary.

A2—2 to 9 inches (5 to 23 centimeters); dark grayish brown (10YR 4/2), broken face, silt loam, very dark grayish brown (10YR 3/2), broken face, moist; 25 percent clay; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and common very fine roots; common very fine interstitial pores; 5 percent subrounded indurated 10- to 30-millimeter mixed rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

ABt—9 to 18 inches (23 to 46 centimeters); dark grayish brown (10YR 4/2), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 32 percent clay; strong fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few very fine roots; common very fine interstitial pores; slightly acid, pH 6.5 by pH meter 1:1 water; clear smooth boundary.

Bt1—18 to 27 inches (46 to 69 centimeters); dark grayish brown (10YR 4/2), broken face, silty clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 34 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; few very fine roots; common very

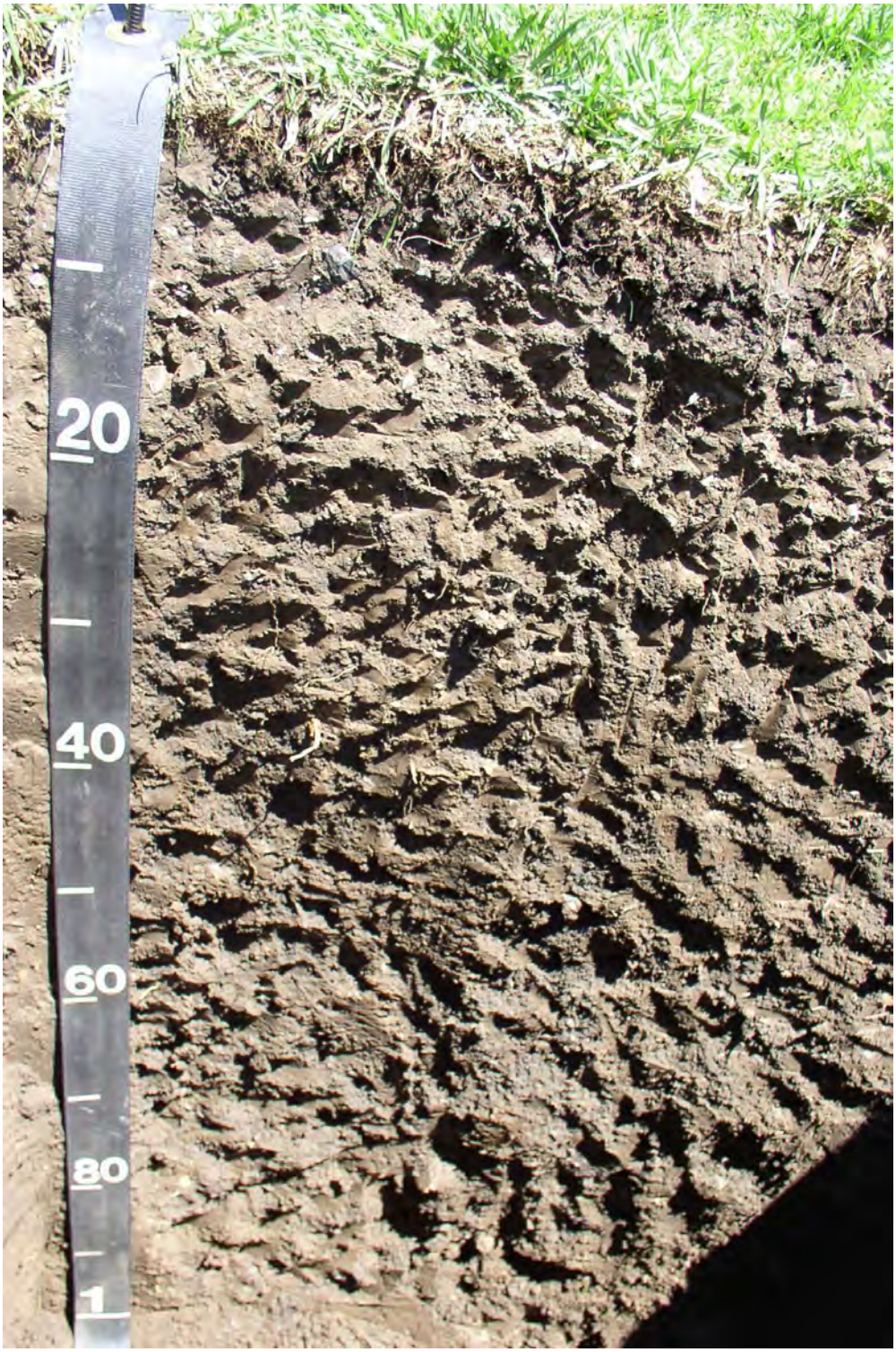


Figure 72.—Representative profile of the Stevenscreek series. These very deep and fertile alluvial fan soils have very thick A horizons and dark colors that extend into the Bt horizons. Organic matter content is relatively high, and textures are silty. Clay content increases from about 17 to 25 percent to more than 30 percent in the Bt horizon below a depth of 46 centimeters.

Figure 73.—Landscape of Stevenscreek soils. Photo was taken during the sampling of the type location in Eagle Park, City of Mountain View. Slopes are nearly level. These soils are on lower alluvial fans where silty floodwaters deposited silts on a regular basis until flooding was controlled by upstream dams. They are naturally very fertile and well adapted to growing a large variety of plants. Nearly all of these soils have been urbanized.

fine interstitial pores; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

Bt2—27 to 39 inches (69 to 100 centimeters); dark grayish brown (10YR 4/2), broken face, clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 34 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine interstitial pores; neutral, pH 6.8 by pH meter 1:1 water; clear wavy boundary.

BCt—39 to 61 inches (100 to 155 centimeters); brown (10YR 5/3), broken face, sandy clay loam, dark brown (10YR 3/3), broken face, moist; 32 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine interstitial pores; 5 percent rounded moderately cemented 10- to 50-millimeter sandstone fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear wavy boundary.

C—61 to 70 inches (155 to 178 centimeters); brown (10YR 5/3), broken face, sandy clay loam, brown (10YR 4/3), broken face, moist; 28 percent clay; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine interstitial pores; slightly alkaline, pH 7.4 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section is 25 to 100 centimeters thick and averages 27 to 35

percent clay and 0 to 15 percent rock fragments (mostly gravel). Mineralogy is mixed. Organic matter content ranges from 1.5 to 4 percent to a depth of 23 centimeters.

The A horizon has dry color of 10YR 5/3, 5/2, 4/3, 4/2, 4/1, 3/3, or 3/2 and moist color of 10YR 3/3, 3/2, 3/1, 2/2, or 2/1. Texture is sandy loam, fine sandy loam, silt loam, loam, sandy clay loam, or clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 5.1 to 7.8.

The Bt horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/4, 4/3, 4/2, 4/1, or 3/2 or 2.5Y 4/2 and moist color of 10YR 4/4, 4/3, 3/4, 3/3, 3/2, 2/2, or 2/1 or 2.5Y 3/2. Texture is sandy clay loam, silty clay loam, or clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The BCt and C horizons have dry color of 10YR 6/4, 5/4, 5/3, 4/4, 4/3, or 4/2 or 2.5Y 4/2 and moist color of 10YR 4/4, 4/3, 3/4, 3/3, or 3/2 or 2.5Y 3/2. Texture is sandy clay loam or clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 0 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.8.

Still Series

The Still series consists of very deep, well drained soils that formed in alluvium from mixed rock sources (fig. 74). Still soils are on flood plains and alluvial fans (fig. 75). Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, thermic Cumulic Haploxerolls

Typical Pedon

Still sandy loam in an area of Urban land-Still complex, 0 to 2 percent slopes; Santa Clara County, California; City of Palo Alto, El Palo Alto Park, on a south-facing 1 percent slope under a cover of eucalyptus and annual grasses, in a nonsectionized area of T. 5 S., R. 3 W.; at an elevation of 22 meters; UTM Zone 10, Northing 4144766, Easting 573426, NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 2 inches (0 to 4 centimeters); black (7.5YR 2.5/1), broken face, sandy loam, black (10YR 2/1), broken face, moist; 15 percent clay; moderate fine granular structure; moderately hard, very friable, nonsticky and nonplastic; common fine and common very fine roots; common very fine interstitial pores; neutral, pH 7.1 by pH meter 1:1 water; abrupt smooth boundary.

Ad—2 to 12 inches (4 to 30 centimeters); brown (10YR 5/3), broken face, very fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 18 percent clay; weak medium angular blocky structure; very hard, firm, moderately sticky and slightly plastic; common very fine roots; common very fine interstitial pores; neutral, pH 7.1 by pH meter 1:1 water; clear smooth boundary.

Bw1—12 to 20 inches (30 to 50 centimeters); brown (10YR 5/3), broken face, silt loam, very dark grayish brown (10YR 3/2), broken face, moist; 21 percent clay; weak medium subangular blocky structure; moderately hard, very friable, moderately sticky and slightly plastic; common fine roots; common very fine interstitial pores; neutral, pH 7.3 by pH meter 1:1 water; clear smooth boundary.

Bw2—20 to 33 inches (50 to 83 centimeters); brown (10YR 5/3), broken face, silt loam, dark grayish brown (10YR 4/2), broken face, moist; 23 percent clay; weak medium subangular blocky structure; moderately hard, very friable, moderately sticky and slightly plastic; common very fine roots; common very fine interstitial pores; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

Figure 74.—Representative profile of the Still series. This very deep and fertile soil occurs along stream channels and has layers of slightly different textures. The A horizon is sandy loam or very fine sandy loam to a depth of 30 centimeters, which reflects flooding events depositing the materials. The A horizon also has a traffic pan and is compacted between the arrows in the photo. Silt loam continues to a depth of 83 centimeters. Next is a buried A horizon with darker soil colors and a different texture of loam. This horizon continues to a depth of 182 centimeters.

Figure 75.—Landscape of Still soils. Photo was taken in El Palo Alto Park in the City of Palo Alto, on the banks of San Francisquito Creek near El Camino Real. Most areas away from the creek channel have been urbanized.

2Ab1—33 to 37 inches (83 to 95 centimeters); brown (10YR 4/3), broken face, loam, very dark brown (10YR 2/2), broken face, moist; 21 percent clay; weak medium subangular blocky structure; moderately hard, very friable, moderately sticky and slightly plastic; common very fine roots; common fine and common very fine interstitial pores; neutral, pH 6.8 by pH meter 1:1 water; clear smooth boundary.

2Ab2—37 to 51 inches (95 to 130 centimeters); brown (10YR 5/3), broken face, loam, very dark grayish brown (10YR 3/2), broken face, moist; 19 percent clay; weak medium subangular blocky structure; hard, very friable, moderately sticky and slightly plastic; common very fine roots; common very fine interstitial pores; neutral, pH 6.7 by pH meter 1:1 water; clear smooth boundary.

2Bwb1—51 to 62 inches (130 to 158 centimeters); brown (10YR 5/3), broken face, loam, very dark grayish brown (10YR 3/2), broken face, moist; 24 percent clay; weak medium subangular blocky structure; hard, very friable, moderately sticky and slightly plastic; common very fine interstitial pores; neutral, pH 6.7 by pH meter 1:1 water; clear smooth boundary.

2Bwb2—62 to 72 inches (158 to 182 centimeters); brown (10YR 5/3), broken face, loam, very dark grayish brown (10YR 3/2), broken face, moist; 24 percent clay; weak medium subangular blocky structure; moderately hard, very friable, moderately sticky and slightly plastic; common very fine interstitial pores; neutral, pH 6.9 by pH meter 1:1 water.

Range in Characteristics

Depth to the buried A horizon ranges from 40 to 130 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control

section averages 18 to 26 percent clay. Mineralogy is mixed. Organic matter content ranges from 1 to 4 percent to a depth of 30 centimeters and from 0.5 to 2 percent to a depth of 83 centimeters.

The A horizon has dry color of 10YR 5/3 or 4/2 or 7.5YR 2.5/1 and moist color of 10YR 3/3, 3/2, 2/2, or 2/1. Texture is sandy loam or very fine sandy loam. Clay content ranges from 15 to 22 percent. Rock fragments range from 0 to 10 percent rounded gravel. Reaction ranges from pH 6.6 to 8.2.

The Bw horizon has dry color of 10YR 5/3 or 4/3 and moist color of 10YR 4/2 or 2/2. Texture is fine sandy loam or silt loam. Clay content ranges from 18 to 22 percent. Rock fragments range from 0 to 5 percent rounded gravel. Reaction ranges from pH 6.6 to 8.2.

The 2Ab horizon has dry color of 10YR 5/3, 4/3, or 3/3 and moist color of 10YR 4/3, 3/2, or 2/2. Texture is fine sandy loam, silt loam, or loam. Clay content ranges from 18 to 26 percent. Rock fragments range from 0 to 5 percent rounded gravel. Reaction ranges from pH 6.6 to 8.2.

The 2Bwb horizon has dry color of 10YR 6/3 or 5/3 and moist color of 10YR 4/3 or 3/2. Texture is fine sandy loam, silt loam, or loam. Clay content ranges from 18 to 26 percent. Rock fragments range from 0 to 5 percent rounded gravel. Reaction ranges from pH 6.6 to 8.2.

Sur Series

The Sur series consists of moderately deep, somewhat excessively drained soils that formed in residuum weathered from schist, sandstone, shale, gneiss, and granitic rocks. Sur soils are on uplands and have slopes of 30 to 85 percent. The mean annual precipitation is about 55 inches, and the mean annual air temperature is about 55 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Entic Haploxerolls

Typical Pedon

Sur stony sandy loam; Monterey County, California; 1.1 miles east from the summit of Nacimiento-Ferguson Road, 0.3 mile northeast from Carrals Springs, under mixed hardwoods, in SE1/4 SE1/4 SE1/4 of section 17, T. 22 S., R. 5 E. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 2 inches (0 to 5 centimeters); variable litter of oak, tanoak, laurel, and madrone leaves and twigs; slightly acid (pH 6.4); abrupt wavy boundary. (0 to 4 inches thick)

A—2 to 7 inches (5 to 18 centimeters); very dark grayish brown (10YR 3/2) stony sandy loam, very dark brown (10YR 2/2) moist; soft, very friable, nonsticky and nonplastic; common very fine roots; common fine tubular and many very fine and fine interstitial pores; about 3 percent subangular surface stones and cobbles; and 5 to 10 percent mostly 2- to 20-millimeter but ranging to 60-millimeter subangular fragments; slightly acid (pH 6.5); clear wavy boundary. (7 to 20 inches thick)

C—7 to 24 inches (18 to 61 centimeters); brown (7.5YR 5/4) stony sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky and weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine tubular and interstitial and common fine tubular pores; 40 to 50 percent, by volume, subangular stones, cobbles, and smaller fragments; fragment content increases with increasing depth; slightly acid (pH 6.4); clear irregular boundary. (10 to 35 inches thick)

R—24 to 30 inches (61 to 76 centimeters); fractured schist; some soil in fractures.

Range in Characteristics

Depth to a lithic contact is 20 to 40 inches. The mean annual soil temperature is 54 to 58 degrees F, and the soil temperature typically is not below 47 degrees F or is not below 47 degrees F after mid-February. The soil between depths of about 8 and 25 inches typically is dry all of the time from June until October and moist in all parts the rest of the year. Rock fragments average 35 to 65 percent, by volume, below a depth of 10 inches. Textures throughout the profile are coarse sandy loam, sandy loam, or fine sandy loam. The soils are moderately acid to neutral.

The A horizon is dark gray, gray, grayish brown, dark grayish brown, very dark grayish brown, or brown (10YR 5/1, 4/1, 4/2, 3/2, or 5/3). It has 3 to 8 percent organic matter in the upper part; the content decreases regularly to less than 1 percent between depths of 10 and 20 inches. Base saturation is 75 to 90 percent.

The C horizon is brown, light brown, pale brown, or light yellowish brown. In some pedons it is massive, and in others it has subangular blocky or granular structure.

Tierra Series

The Tierra series consists of very deep, moderately well drained soils that formed in alluvial materials from sedimentary rocks. Tierra soils are on dissected terraces and low hills and have slopes of 2 to 50 percent. The mean annual precipitation is about 18 inches, and the mean annual air temperature is about 58 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Mollic Palexeralfs

Typical Pedon

Tierra loam; Santa Barbara County, California; 2.25 miles south of Guadalupe, 0.9 mile west on Brown Road from its intersection with California Highway No. 1, about 1,980 feet south of Brown Road, in an area under annual grasses that was formerly cultivated. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 7 inches (0 to 18 centimeters); grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine interstitial and common very fine and medium tubular pores; strongly acid (pH 5.5); gradual smooth boundary. (5 to 10 inches thick)

A—7 to 11 inches (18 to 28 centimeters); gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine and many very fine interstitial and many very fine tubular pores; moderately acid (pH 6.0); abrupt smooth boundary. (5 to 14 inches thick)

Bt1—12 to 16 inches (28 to 41 centimeters); very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate coarse prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots concentrated along faces of peds; few very fine interstitial and few very fine tubular pores; many moderately thick clay films on faces of peds and continuous thin clay films lining pores; slightly acid (pH 6.5); gradual smooth boundary. (4 to 20 inches thick)

Bt2—16 to 25 inches (41 to 64 centimeters); dark brown (10YR 4/3) clay (not as fine as horizon above), dark brown (10YR 3/3) moist; weak coarse prismatic and moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots on faces of peds; few very fine interstitial and

few very fine tubular pores; continuous thin clay films on faces of peds and lining pores; slightly acid (pH 6.5); gradual smooth boundary. (8 to 12 inches thick)

Bt3—25 to 43 inches (64 to 109 centimeters); light brownish gray (10YR 6/2) heavy clay loam, grayish brown (10YR 5/2) moist; many large prominent reddish brown (5YR 5/4 or 4/4) mottles; moderate medium angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; few fine interstitial and common very fine and fine tubular pores; many thin and few moderately thick clay films on faces of peds and few moderately thick clay films lining tubular pores; moderately alkaline (pH 8.0); clear smooth boundary. (15 to 20 inches thick)

C—43 to 62 inches (109 to 157 centimeters); pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; many large prominent reddish brown (2.5YR 5/4) and yellowish brown (10YR 5/4) mottles; strong medium angular blocky structure; very hard, firm, sticky and plastic; few very fine interstitial and tubular pores; common thin very dark brown clay films on faces of peds and joints; mildly alkaline (pH 7.5).

Range in Characteristics

Typically, the soil between depths of about 5 and 15 inches is continuously moist from November until late April or May and is dry the rest of the year. The mean annual soil temperature is 59 to 64 degrees F. The mean summer soil temperature is about 68 degrees F, and the mean winter soil temperature is about 57 degrees F. Except for some C horizons deep in the profile, the amount of rock fragments is low, less than 15 percent.

The Ap and A horizons are gray to very dark gray, grayish brown to dark grayish brown, or brown (10YR 5/1, 4/1, 3/1, 5/2, or 4/2; N 5/; or 2.5Y 5/1, 5/2, or 5/3). Texture ranges from loamy sand to clay loam, but in most pedons it is fine sandy loam or loam. This horizon is massive and is hard or very hard in some or all parts. It has 1.5 to 5 percent organic matter. It is slightly acid to strongly acid and has base saturation of 50 to 75 percent.

The AB horizon (if it occurs) is gray, light gray, light brownish gray, white, pale brown, or very pale brown and has color value one or two units higher than the A or Ap horizon and, in most pedons, one to three units higher than the Bt horizon.

The upper part of the Bt horizon is grayish brown, dark grayish brown, or very dark grayish brown. The lower part is light brownish gray, grayish brown, yellowish brown, dark yellowish brown, pale brown, or brown. Hue is dominantly 10YR in all of the Bt horizon, but hue of 2.5Y is included. The exterior of the peds has lower value and lower chroma, with generally less staining and lighter and brighter color in the lower part. The horizon has 35 to 50 percent clay and an abrupt upper boundary; it has 15 to 30 percent more clay (absolute) than the A or Ap horizon. The Bt horizon has moderate to strong prismatic structure in the upper part, weak to moderate prismatic or moderate to strong prismatic structure in the middle part, and weak to moderate prismatic or moderate to strong angular blocky structure in the lower part. In some pedons, this horizon has coarse mottles or blotches of brighter colors, particularly in the lower part. The Bt horizon is neutral to moderately acid and in most pedons becomes less acid as depth increases. Base saturation is more than 75 percent in most or all parts. The lower part is less acid as depth increases. Base saturation is more than 75 percent in most or all parts. The lower boundary of the Bt horizon is gradual or there is a BC horizon 15 to 30 inches thick.

The C horizon has hue of 2.5Y or 10YR and dry value of 6 or 7. It is sandy loam, loam, clay loam, or sandy clay loam and is slightly hard to very hard when dry. In some pedons, some or all of the horizon is weakly cemented and dense. Reaction ranges from moderately acid to moderately alkaline, and in a few pedons the horizon has free lime in disseminated or segregated form.

Togasara Series

The Togasara series consists of very deep, well drained soils that formed in older alluvium from mixed rock sources (fig. 76). Togasara soils are on terraces (see figure 60). Slopes range from 2 to 30 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, thermic Typic Argixerolls

Typical Pedon

Togasara gravelly sandy loam in an area of Togasara-Montavista complex, 15 to 30 percent slopes; Santa Clara County, California; Rancho San Antonio Open Space, Los Altos, west of the main parking across the creek and south on the ridge, on an east-facing 16 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 7 S., R. 2 W.; at an elevation of 367 feet; UTM Zone 10, Northing 4132046, Easting 580795, NAD83; USGS quadrangle: Cupertino, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 3 inches (0 to 8 centimeters); brown (10YR 4/3), broken face, gravelly sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 17 percent clay; moderate medium subangular blocky and moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; 15 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

ABt—3 to 7 inches (8 to 19 centimeters); brown (10YR 4/3), broken face, gravelly sandy clay loam, dark brown (10YR 3/3), broken face, moist; 23 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; many very fine roots; many very fine interstitial pores; 40 percent clay films on all faces of peds; 15 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.3 by pH meter 1:1 water; abrupt smooth boundary.

Bt1—7 to 16 inches (19 to 41 centimeters); brown (7.5YR 5/4), broken face, very gravelly sandy clay loam, brown (7.5YR 4/4), broken face, moist; 25 percent clay; strong medium subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common very fine roots; many very fine interstitial pores; 50 percent clay films on all faces of peds; 50 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.3 by pH meter 1:1 water; gradual smooth boundary.

Bt2—16 to 25 inches (41 to 63 centimeters); light brown (7.5YR 6/4), broken face, very gravelly sandy clay loam, brown (7.5YR 5/4), broken face, moist; 26 percent clay; strong fine subangular blocky structure; hard, friable, moderately sticky and moderately plastic; few very fine roots; many very fine interstitial pores; 60 percent clay films on all faces of peds; 55 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; gradual smooth boundary.

Bt3—25 to 35 inches (63 to 90 centimeters); brown (7.5YR 5/4), broken face, very gravelly sandy clay loam, brown (7.5YR 4/4), broken face, moist; 25 percent clay; moderate fine subangular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; many very fine interstitial pores; 60 percent clay films on all faces of peds; 55 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 6.7 by pH meter 1:1 water; clear smooth boundary.

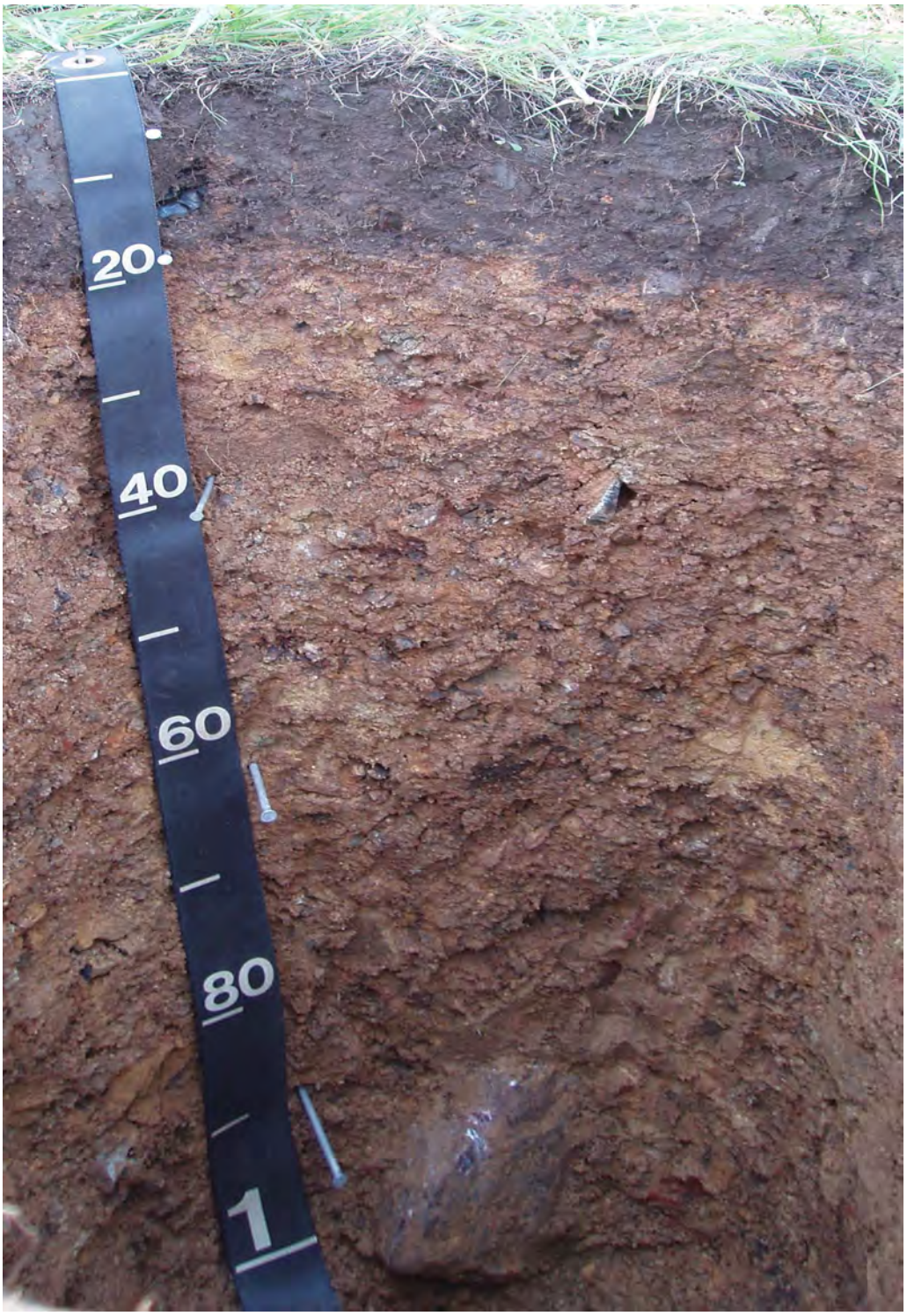


Figure 76.—Representative profile of the Togasara series. The brown gravelly A horizon extends to a depth of 19 centimeters and ends abruptly at the top of the Bt horizon. The very gravelly Bt horizon extends to a depth of 90 centimeters. This horizon is very difficult to excavate due to the volume of rock fragments. The BC horizon, which is below a depth of 90 centimeters, is extremely gravelly and has rounded and subrounded fragments. Togasara soils are terrace soils that were deposited by water a long time ago and have weathered and been eroded into rolling hills.

BC1—35 to 48 inches (90 to 123 centimeters); brownish yellow (10YR 6/6), broken face, extremely gravelly sandy clay loam, dark yellowish brown (10YR 4/6), broken face, moist; 20 percent clay; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and moderately plastic; many very fine interstitial pores; 10 percent clay films on all faces of peds; 5 percent subrounded indurated 75- to 254-millimeter mixed rock fragments and 55 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 6.7 by pH meter 1:1 water; abrupt smooth boundary.

BC2—48 to 59 inches (123 to 150 centimeters); light yellowish brown (10YR 6/4), broken face, very gravelly sandy loam, yellowish brown (10YR 5/4), broken face, moist; 18 percent clay; massive; soft, friable, slightly sticky and slightly plastic; many very fine interstitial pores; 5 percent subrounded indurated 75- to 254-millimeter mixed rock fragments and 50 percent subrounded indurated 2- to 75-millimeter mixed rock fragments; neutral, pH 6.8 by pH meter 1:1 water.

Range in Characteristics

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about May 1 to November 1 (about 180 days). The particle-size control section averages 25 to 35 percent clay and 15 to 55 percent rock fragments, mostly gravel. Scattered pararock fragments of highly weathered sandstone occur randomly throughout the soil profile. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 2 percent to a depth of 19 centimeters. Rock fragments on the surface range from 0 to 5 percent gravel.

The A and ABt horizons have dry color of 10YR 6/3, 5/3, 4/3, or 3/3 and moist color of 10YR 4/3, 3/3, 3/2, or 2/2. Texture is sandy loam, sandy clay loam, or clay loam or their gravelly analogs. Clay content ranges from 12 to 24 percent. Rock fragments range from 5 to 20 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The Bt horizon has dry color of 10YR 5/6, 5/4, 4/4, or 4/3 or 7.5YR 6/4 or 5/4 and moist color of 10YR 3/6 or 3/4 or 7.5YR 5/4, 4/4, or 3/3. Texture is gravelly or very gravelly sandy clay loam or gravelly or very gravelly clay loam. Clay content ranges from 23 to 35 percent. Rock fragments range from 15 to 55 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The BC horizon has dry color of 10YR 6/6, 6/4, 5/6, 5/4, or 4/4 or 2.5Y 7/4 or 6/4 and moist color of 10YR 5/4, 4/6, or 3/4 or 2.5Y 6/4 or 5/4. Texture is gravelly or very gravelly sandy loam or gravelly or very gravelly sandy clay loam. Clay content ranges from 15 to 28 percent. Rock fragments range from 25 to 55 percent gravel and 0 to 5 percent cobbles. Reaction ranges from pH 6.6 to 7.3.

Typic Haploxeralfs, Limestone

Typic Haploxeralfs, limestone consist of deep, well drained soils that formed in residuum weathered from limestone. These soils are on mountains and hillslopes. Slopes range from 8 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Fine-loamy, mixed, superactive, mesic Typic Haploxeralfs

Typical Pedon

Typic Haploxerolls, limestone; Santa Clara County, California; 100 feet south of a small quarry on the road to Stevens Creek trailhead of the lower Indian Creek Trail in Monte Bello Open Space, on an east-facing 23 percent slope, under a cover of grass and herbaceous cover; at an elevation of 2,000 feet; UTM Zone 10, Northing 4130266.00 meters, Easting 573922.00 meters, NAD83; USGS quadrangle: Mindego Hill,

California. When described, the soil was slightly moist throughout. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Typic Haploxeralfs in this survey area because of the highly variable nature of these soils.

A1—0 to 5 inches (0 to 12 centimeters); dark yellowish brown (10YR 4/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 20 percent clay; strong fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent subrounded moderately cemented 2- to 75-millimeter limestone fragments; limestone fragments are violently effervescent; slightly alkaline, pH 7.4 by pH meter 1:1 water; abrupt smooth boundary.

A2—5 to 22 inches (12 to 55 centimeters); dark yellowish brown (10YR 4/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 3/4), broken face, moist; 22 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent subrounded moderately cemented 2- to 75-millimeter greenstone fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear smooth boundary.

Bt1—22 to 41 inches (55 to 105 centimeters); brown (7.5YR 4/4), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 26 percent clay; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent discontinuous faint clay films on all faces of peds; 15 percent subrounded moderately cemented 2- to 75-millimeter greenstone fragments; slightly alkaline, pH 7.4 by pH meter 1:1 water; clear smooth boundary.

Bt2—41 to 51 inches (105 to 130 centimeters); brown (7.5YR 4/4), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 27 percent clay; weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; 30 percent discontinuous faint clay films on all faces of peds; 15 percent subrounded moderately cemented 2- to 75-millimeter greenstone fragments; slightly alkaline, pH 7.5 by pH meter 1:1 water; clear smooth boundary.

Bt3—51 to 59 inches (130 to 150 centimeters); brown (7.5YR 4/4), broken face, gravelly sandy clay loam, dark brown (7.5YR 3/4), broken face, moist; 28 percent clay; weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; 15 percent discontinuous faint clay films on all faces of peds; 15 percent subrounded moderately cemented 2- to 75-millimeter greenstone fragments; slightly alkaline, pH 7.5 by pH meter 1:1 water.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is more than 60 inches. The mean annual soil temperature is 46 to 59 degrees F. The particle-size control section averages 25 to 35 percent clay and 5 to 35 percent rock fragments, mostly gravel. Rock fragments on the surface range from 5 to 60 percent and are 2 to 75 millimeters in size.

The A horizon has dry color of 10YR 4/4 and moist color of 10YR 3/4. Texture is gravelly sandy clay loam or sandy clay loam. Clay content ranges from 18 to 25 percent. Rock fragments range from 5 to 30 percent and are 2 to 75 millimeters in size. Reaction ranges from slightly acid to moderately alkaline.

The Bt horizon has dry color of 7.5YR 4/4 and moist color of 10YR 3/4. Texture is sandy clay loam or gravelly sandy clay loam. Clay content ranges from 22 to 34 percent. Rock fragments range from 5 to 35 percent and are 2 to 75 millimeters in size. Reaction ranges from neutral to moderately alkaline.

Typic Xerorthents, Acid Sulphate

Typic Xerorthents, acid sulphate consist of deep, moderately well drained soils that formed in alluvium derived from metamorphic, sedimentary rock and metavolcanic rocks. These soils are in marshes, in estuaries, and on artificial levees. Slopes range from 0 to 30 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Fine, mixed, active, thermic Typic Xerorthents

Typical Pedon

Typic Xerorthents, acid sulphate; Santa Clara County, California; Don Edwards National Wildlife Refuge, on a levee between salt ponds, midway between the west levee and a crossroad, in the middle of the levee, on a flat, 0 percent slope; at an elevation of 3 feet; UTM Zone 10, Northing 4144855, Easting 586111, NAD83; USGS quadrangle: Mindego Hill, California. When described, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Typic Xerorthents, acid sulphate in this survey area because of the highly variable nature of these soils.

^Ajz—0 to 6 inches (0 to 15 centimeters); olive gray (5Y 4/2), broken face, silty clay, light olive gray (5Y 6/2), broken face, moist; 45 percent clay; strong medium angular blocky structure; hard, friable, very sticky and moderately plastic; many very fine roots; 5 percent fine distinct jarosite masses on faces of peds; extremely acid, pH 3.6 by pH meter 1:1 water; electrical conductivity of 19.9 decisiemens; abrupt smooth boundary.

^Bjz1—6 to 24 inches (15 to 60 centimeters); olive gray (5Y 5/2), broken face, silty clay, dark olive gray (5Y 3/2), broken face, moist; 45 percent clay; strong medium angular blocky structure; hard, friable, very sticky and moderately plastic; many very fine roots; 10 percent fine distinct jarosite masses on faces of peds; extremely acid, pH 3.7 by pH meter 1:1 water; electrical conductivity of 18.5 decisiemens; abrupt smooth boundary;.

^Bjz2—24 to 37 inches (60 to 95 centimeters); olive gray (5Y 5/2), broken face, silty clay, dark olive gray (5Y 3/2), broken face, moist; 45 percent clay; strong medium angular blocky structure; very hard, friable, very sticky and moderately plastic; many very fine roots; extremely acid, pH 3.7 by pH meter 1:1 water; electrical conductivity of 18.5 decisiemens; abrupt smooth boundary.

^Czg1—37 to 57 inches (95 to 145 centimeters); olive gray (5Y 5/2), broken face, silty clay, dark olive gray (5Y 3/2), broken face, moist; 45 percent clay; moderate medium angular blocky structure; very hard, friable, very sticky and moderately plastic; many very fine roots; 10 percent medium distinct irregular strong brown (7.5YR 4/6), moist, and strong brown (7.5YR 5/6), dry, masses of oxidized iron; extremely acid, pH 3.9 by pH meter 1:1 water; electrical conductivity of 19.9 decisiemens; abrupt smooth boundary.

^Czg2—57 to 59 inches (145 to 150 centimeters); gray (5Y 6/1), broken face, silty clay, very dark gray (5Y 3/1), broken face, moist; 45 percent clay; moderate medium subangular blocky structure; very hard, friable, very sticky and moderately plastic; 20 percent medium distinct irregular brown (7.5YR 4/4), dry, and dark brown (7.5YR 3/4), moist, masses of oxidized iron; extremely acid, pH 3.9 by pH meter 1:1 water; electrical conductivity of 19.9 decisiemens.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to the permanent water table is more than 60 inches because these soils are transported levee material. The mean annual soil temperature is 59 to 72 degrees F. The particle-size control section averages 35 to 50 percent clay and 0 percent rock fragments. Redoximorphic features, such as jarosite (with dry color of 5Y 7/4 or 5Y 5/4), occur in the upper horizons.

The A horizon has dry color of 5Y 4/ and moist color of 5Y 6/2. Texture is clay or silty clay. Clay content ranges from 35 to 50 percent. Redoximorphic features are expressed as jarosite. Electrical conductivity is 19 to more than 20 decisiemens. Reaction ranges from pH 3.5 to 6.

The B horizon has dry color of 5Y 5/2 and moist color of 5Y 3/2. Texture is silty clay or clay. Clay content ranges from 35 to 50 percent. Electrical conductivity is 19 to more than 20 decisiemens. Redoximorphic features are expressed as jarosite concentrations. Reaction ranges from pH 3.6 to 6.

The C horizon has dry color of 5Y 5/2 or 6/1 and moist color of 5Y 3/2 or 3/1. Texture is silty clay or clay. Clay content ranges from 35 to 50 percent. Electrical conductivity is 19 to more than 20 decisiemens. Redoximorphic features are distinct irregular strong brown (7.5YR 4/6), moist, and strong brown (7.5YR 5/6), dry, masses of oxidized iron. Reaction ranges from pH 3.5 to 6.

Ultic Haploxerolls, Loamy-Skeletal

Ultic Haploxerolls, loamy-skeletal consist of deep, well drained soils that formed in residuum weathered from sandstone. These soils are on mountainsides. Slopes range from 15 to 75 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 57 degrees F.

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Ultic Haploxerolls

Typical Pedon

Ultic Haploxerolls, loamy-skeletal; Santa Clara County, California; Skyline Boulevard, near CDF Station, east side of the road to trail, downslope from the trail, on a northeast-facing 63 percent slope under a cover of intermixed conifers and hardwoods; at an elevation of 2,429 feet (740 meters); UTM Zone 10, Northing 4124352, Easting 577010, NAD83; USGS quadrangle: Mindego Hill, California. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Ultic Haploxerolls in this survey area because of the highly variable nature of these soils.

Oe—0 to 2 inches (0 to 4 centimeters); moderately decomposed plant material; abrupt wavy boundary.

A1—2 to 5 inches (4 to 13 centimeters); brown (10YR 5/3), broken face, fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 10 percent clay; strong fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine and common medium irregular pores; 10 percent subangular very strongly cemented 2- to 75-millimeter sandstone fragments; slightly acid, pH 6.3 by pH meter 1:1 water; clear smooth boundary.

A2—5 to 10 inches (13 to 26 centimeters); brown (10YR 5/3), broken face, fine sandy loam, very dark grayish brown (10YR 3/2), broken face, moist; 10 percent clay; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and common medium roots; common fine, common medium, and common coarse irregular pores; 5 percent subangular very strongly cemented 75- to 250-millimeter sandstone fragments and 10 percent subangular very strongly cemented 2- to 75-millimeter sandstone fragments; moderately acid, pH 6.1 by pH meter 1:1 water; clear smooth boundary.

Bw1—10 to 25 inches (26 to 64 centimeters); light yellowish brown (10YR 6/4), broken face, sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 18 percent clay; moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common medium and common coarse roots; common fine and common medium irregular pores; 10 percent subangular very strongly cemented 250- to 600-millimeter sandstone fragments, 10 percent subangular very strongly cemented 75- to 250-millimeter sandstone fragments, and 15 percent subangular very strongly cemented 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.3 by pH meter 1:1 water; gradual wavy boundary.

Bw2—25 to 34 inches (64 to 87 centimeters); light yellowish brown (10YR 6/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 20 percent clay; moderate fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common medium and common coarse roots; common fine irregular pores; 15 percent subangular very strongly cemented 250- to 600-millimeter sandstone fragments, 15 percent subangular very strongly cemented 75- to 250-millimeter sandstone fragments, and 20 percent subangular very strongly cemented 2- to 75-millimeter sandstone fragments; strongly acid, pH 5.6 by pH meter 1:1 water; clear wavy boundary.

C—34 to 43 inches (87 to 109 centimeters); light yellowish brown (10YR 6/4), broken face, extremely stony sandy loam, dark yellowish brown (10YR 4/4), broken face, moist; 14 percent clay; massive; soft, very friable, nonsticky and nonplastic; common medium roots; common fine irregular pores; 10 percent subangular very strongly cemented 75- to 250-millimeter sandstone fragments, 10 percent subangular very strongly cemented 2- to 75-millimeter sandstone fragments, and 60 percent subangular very strongly cemented 250- to 600-millimeter sandstone fragments; strongly acid, pH 5.5 by pH meter 1:1 water; abrupt wavy boundary.

R—43 to 50 inches (109 to 127 centimeters); strongly cemented sandstone.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is 40 to 60 inches. The mean annual soil temperature is 47 to 58 degrees F. The particle-size control section averages 8 to 22 percent clay and 10 to 45 percent coarse fragments.

The A horizon has dry color of 10YR 5/3 and moist color of 10YR 3/2. Texture is fine sandy loam or gravelly fine sandy loam. Clay content ranges from 8 to 18 percent. Rock fragments range from 5 to 20 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 4.5 to 6.6.

The Bw horizon has dry color of 10YR 6/4 and moist color of 10YR 4/4. Texture is stony, very gravelly, or gravelly sandy loam or sandy clay loam. Clay content ranges from 18 to 22 percent. Rock fragments range from 10 to 45 percent and are 2 to 75, 75 to 250, or 250 to 600 millimeters in size. Reaction ranges from pH 4.5 to 6.6.

The C horizon has dry color of 10YR 6/4 and moist color of 10YR 4/4. Texture is extremely stony to very gravelly sandy loam. Clay content ranges from 10 to 18 percent. Rock fragments range from 35 to 80 percent. Reaction ranges from pH 4.5 to 6.6.

Ultic Palexerolls

Ultic Palexerolls consist of moderately deep, well drained soils that formed in residuum weathered from sandstone, shale, and mudstone. These soils are on mountains and terraces. Slopes range from 5 to 30 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 55 degrees F.

Taxonomic Classification

Fine, smectitic, mesic Ultic Palexerolls (Note: These were Lampico Variant soils that were changed to a higher category classification.)

Typical Pedon

Ultic Palexerolls; Santa Cruz County, California; about 1.51 miles north and 0.25 mile east of the fork of Granice Creek Road and Branciforte Drive, on an east-facing 18 percent slope under a cover of coniferous trees, about 2,350 feet south of the center of section 20, T. 10 S., R. 1 W.; at an elevation of 518 feet; lat. 37 degrees 2 minutes 25 seconds N. and long. 121 degrees 59 minutes 33 seconds W., NAD83 (Coodinates were obtained by GIS methods from location of type location symbol on 1980 published Santa Cruz soil survey maps and should be considered approximate); USGS quadrangle: Laurel, California. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Ultic Palexerolls in this survey area because of the highly variable nature of these soils.

A1—0 to 5 inches (0 to 13 centimeters); dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium and moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; many fine, common medium, and many very fine roots; many fine and many very fine interstitial pores; slightly acid (pH 6.3); gradual wavy boundary.

A2—5 to 10 inches (13 to 25 centimeters); dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium and moderate coarse granular structure; hard, friable, slightly sticky and slightly plastic; many fine, many medium, few coarse, and many very fine roots; many fine and many very fine interstitial pores; slightly acid (pH 6.3); clear wavy boundary.

A3—10 to 14 inches (25 to 36 centimeters); dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate coarse and moderate medium angular blocky structure; hard, friable, moderately sticky and moderately plastic; many fine, many medium, many coarse, and many very fine roots; few pressure cutans; moderately acid (pH 5.8); abrupt wavy boundary.

Bt1—14 to 19 inches (36 to 48 centimeters); dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) and brown (7.5YR 4/4) moist; moderate medium and moderate coarse angular blocky structure; extremely hard, firm, moderately sticky and very plastic; common fine, many medium, many coarse, and common very fine roots; many fine and many very fine tubular pores; 2 percent clay films on surfaces along pores and 2 percent clay films on all faces of peds; moderately acid (pH 5.8); diffuse irregular boundary.

Bt2—19 to 23 inches (48 to 58 centimeters); brown (7.5YR 4/2), strong brown (7.5YR 5/6), and brown (7.5YR 4/4) clay, dark grayish brown (10YR 4/2), brown (7.5YR 4/4), and dark yellowish brown (10YR 4/4), rubbed, and very dark grayish brown (10YR 3/2) moist; moderate coarse and moderate very coarse angular blocky structure; extremely hard, firm, very sticky and very plastic; common fine, common medium, common coarse, and common very fine roots; many fine and many very fine tubular pores; 2 percent clay films on surfaces along pores and 2 percent clay films on all faces of peds; strongly acid (pH 5.3); diffuse irregular boundary.

Bt3—23 to 28 inches (58 to 71 centimeters); very dark grayish brown (10YR 3/2), brown (7.5YR 4/4), and yellowish brown (10YR 5/4) clay, brown (10YR 4/3), rubbed, and very dark grayish brown (10YR 3/2) moist; moderate coarse and moderate very coarse angular blocky structure; extremely hard, firm, very sticky and very plastic; few fine, common medium, common coarse, and few very fine roots; many fine tubular pores; 2 percent clay films on surfaces along pores and 2 percent clay films on all faces of peds; very strongly acid (pH 4.7); diffuse irregular boundary.

Cr—28 to 36 inches (71 to 91 centimeters); moderately cemented, very strongly acid (pH 4.7) shale.

Range in Characteristics

These soils are represented at a taxonomic level higher than the series because of the variability of the landscape at the scale of mapping.

Depth to bedrock is 20 to 40 inches. The mean annual soil temperature is 47 to 58 degrees F. The particle-size control section averages 40 to 60 percent clay and 0 to 9 percent rock fragments, mostly 2 to 75 millimeters in size.

The A horizon has dry color of 10YR 4/2 and moist color of 10YR 2/2. It is loam or clay loam. Clay content ranges from 20 to 35 percent. Rock fragments range from 0 to 9 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 5.6 to 7.3.

The Bt horizon has dry color of 10YR 4/4 or 3/2 or 7.5YR 4/2 or 4/4 and moist color of 10YR 3/2, 4/3, or 4/4 or 7.5YR 4/2 or 4/4. Texture is clay. Clay content ranges from 40 to 60 percent. Rock fragments range from 0 to 9 percent and are 2 to 75 millimeters in size. Reaction ranges from pH 4.5 to 6.0.

Unistan Series

The Unistan series consists of shallow, well drained soils that formed in residuum from basalt (fig. 77). Unistan soils are on hills (fig. 78). Slopes range from 5 to 30 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 59 degrees F.

Figure 77.—Representative profile of the Unistan series. These lithic soils are shallow with little soil development other than a darkening of the soil material by organic matter. Texture is clay loam or clay. The basalt parent materials weather to the finer textures. Although Unistan soils have more than 35 percent fragments, they maintain good grass cover and scattered oaks in some areas.

Figure 78.—Landscape of Unistan soils. Photo was taken on the Stanford University Academic Preserve looking south across the Page Mill Road area. Unistan soils are in the foreground and on the ridges in the distance.

Taxonomic Classification

Clayey-skeletal, smectitic, thermic Lithic Haploxerolls

Typical Pedon

Unistan gravelly clay loam in an area of Unistan-Rock outcrop complex, 15 to 30 percent slopes; Santa Clara County, California; Stanford University Academic Preserve, east of a large basalt quarry, east over the ridge on a southeast-facing 20 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 6 S., R. 3 W.; at an elevation of 269 feet; UTM Zone 10, Northing 4139648, Easting 574274, NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A—0 to 2 inches (0 to 6 centimeters); brown (10YR 4/3), broken face, gravelly clay loam, dark brown (10YR 3/3), broken face, moist; 37 percent clay; moderate fine granular structure; slightly hard, very friable, moderately sticky and moderately plastic; many very fine roots; few very fine tubular pores; 30 percent clay films on all faces of peds; 15 percent angular strongly cemented 2- to 75-millimeter basalt fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

Bw—2 to 11 inches (6 to 28 centimeters); dark brown (10YR 3/3), broken face, very gravelly clay loam, (10YR 2.5/2), broken face, moist; 38 percent clay; weak medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine roots; many very fine interstitial pores; 70 percent clay films on all faces of peds; 5 percent angular strongly cemented 75- to 254-millimeter basalt fragments and 40 percent angular strongly cemented 2- to

75-millimeter basalt fragments; slightly acid, pH 6.3 by pH meter 1:1 water; abrupt smooth boundary.

R—11 to 13 inches (28 to 34 centimeters); strongly cemented basalt.

Range in Characteristics

Depth to basalt is 7 to 19 inches (17 to 48 centimeters). The mean annual soil temperature is 58 to 62 degrees F. The particle-size control section averages 35 to 45 percent clay, 15 to 40 percent gravel, and 5 to 50 percent cobbles. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 20 centimeters. Rock fragments on the surface range from 0 to 10 percent gravel and 0 to 5 percent cobbles.

The A horizon has dry color of 10YR 4/3, 4/2, or 3/2 and moist color of 10YR 3/3, 3/2, or 2/2. Texture is clay loam. Clay content ranges from 35 to 40 percent. Rock fragments range from 10 to 25 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The Bw horizon has dry color of 10YR 4/2 or 3/3 or 7.5YR 4/3 or 3/2 and moist color of 10YR 3/2 or 2/2 or 7.5YR 3/3 or 2.5/2. Texture is clay loam or clay. Clay content ranges from 35 to 45 percent. Rock fragments range from 15 to 40 percent gravel and 5 to 50 percent cobbles. Reaction ranges from pH 6.1 to 7.3.

Vallecitos Series

The Vallecitos series consists of shallow, well drained soils that formed in residuum from metamorphic bedrock. Vallecitos soils are on hills and have slopes of 9 to 75 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Clayey, smectitic, thermic Lithic Ruptic-Inceptic Haploxeralfs

Typical Pedon

Vallecitos gravelly loam; Alameda County, California; in rangeland, 0.5 mile north and 0.1 mile east of the northwest corner of section 9, T. 5 S., R. 4 E. (Colors are for dry soil unless otherwise noted.)

A1—0 to 1.5 inches (0 to 4 centimeters); brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; moderately acid (pH 6.0); clear smooth boundary. (1 to 3 inches thick)

A2—1.5 to 6 inches (4 to 15 centimeters); brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 3/3) moist; massive; hard, friable, slightly sticky and plastic; many very fine roots; many very fine pores; slightly acid (pH 6.5); abrupt wavy boundary. (3 to 9 inches thick)

Bt1—6 to 12 inches (15 to 31 centimeters); reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak angular blocky structure; very hard, firm, slightly sticky and very plastic; common very fine roots; many very fine pores; thin continuous clay films lining pores and as bridges; neutral (pH 7.0); clear smooth boundary. (0 to 12 inches thick)

Bt2—12 to 16 inches (31 to 41 centimeters); brown (10YR 4/3) clay loam, brown (10YR 4/3) moist; massive; very hard, firm, slightly sticky and very plastic; few very fine roots; common very fine pores; thin continuous clay films lining pores and as bridges; neutral (pH 7.0); abrupt broken boundary. (0 to 8 inches thick)

R—16 to 20 inches (41 to 51 centimeters); bluish gray (5B 5/1) metamorphosed bedrock; clay films along cleavage planes.

Range in Characteristics

Depth to a lithic contact is 10 to 20 inches. Depth to bedrock varies sharply over a surface distance of 20 to 80 inches. Typically, the soil below a depth of 5 inches is continuously moist in some or all parts from November until April or May and is dry the rest of the year. The mean annual soil temperature is about 61 to 67 degrees F. Reaction ranges from neutral to moderately acid throughout the profile; pH is not below 6.0 and does not become more acid with depth. Rock fragments are dominantly less than 1.5 inches in diameter and make up less than 30 percent of the profile.

The A horizon has dry color of 10YR 6/3, 5/2, 5/3, or 5/4 or 7.5YR 6/2, 5/2, 5/3, or 5/4 and moist color of 10YR 4/3, 4/2, or 3/3 or 7.5YR 4/2, 3/3, or 3/2. The horizon is loam, fine sandy loam, or gravelly loam and in most pedons is massive and hard in some or all parts. Organic matter is about 1.2 to 2 percent in most parts and is as much as 4 to 5 percent in the uppermost few inches. The lower boundary is abrupt to clear. The horizon has 20 to 27 percent clay and 0 to 25 percent gravel.

The Bt horizon has dry color of 10YR 6/3, 6/2, or 4/3; 7.5YR 4/4, 5/4, 5/6, 6/2, or 6/4; or, more commonly, 5YR 4/3, 4/6, 5/3, 5/4, 5/6, 6/3, or 6/4. It has moist color of 10YR 4/3, 4/2, or 3/3; 7.5YR 4/4 or 4/2; or 5YR 4/4, 4/3, or 3/3. Texture is clay loam, clay, gravelly clay loam, or gravelly clay. This horizon is massive or has weak to moderate angular or subangular blocky structure. Some pedons do not have a Bt horizon. The horizon has 35 to 50 percent clay and 0 to 30 percent gravel.

Some pedons have a clay loam BA horizon. This horizon has the same range in color as the Bt horizon. In pedons that do not have a Bt horizon, there is an associated BA horizon or a Bw horizon 2 to 7 inches thick. The BA horizon is brown or reddish brown with hue of 7.5YR or 5YR and has one or two units higher chroma or a redder hue than the A horizon, or both. Texture is heavy loam or clay loam, but the difference in clay content between the A horizon and the Bt horizon is less than 20 percent. The BA horizon has few or common thin clay films.

Watsonville Series

The Watsonville series consists of very deep, somewhat poorly drained soils that formed in alluvium. Watsonville soils are on old coastal terraces and in valleys and have slopes of 0 to 50 percent. The mean annual precipitation is about 28 inches, and the mean annual air temperature is about 58 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Xeric Argialbolls

Typical Pedon

Watsonville loam; Santa Cruz County, California; about 950 feet southwest from the intersection of East Lake Avenue (Highway 152) and Carlton Road, in a cultivated area, in the SE1/4 NE1/4 NE1/4 of section 27, T. 11 S., R. 2 E. (projected); lat. 36 degrees 57 minutes 3 seconds N. and long. 121 degrees 43 minutes 47 seconds W., NAD83; USGS quadrangle: Watsonville East, California. (Colors are for dry soil unless otherwise noted.)

Ap—0 to 12 inches (0 to 31 centimeters); very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; slightly acid (pH 6.5); abrupt wavy boundary. (10 to 16 inches thick)

E—12 to 18 inches (31 to 46 centimeters); light gray (10YR 7/2) sandy loam, dark grayish brown (10YR 4/2) moist; many fine prominent yellowish brown (10YR 5/6) mottles; many fine distinct light brownish gray (10YR 6/2) mottles, moist; moderate

medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and very fine roots; common fine and very fine tubular pores; slightly acid (pH 6.5); abrupt wavy boundary. (3/8 inch to 24 inches thick)

Bt1—18 to 26 inches (46 to 66 centimeters); pale brown (10YR 6/3) clay, dark grayish brown (10YR 4/2) moist; common medium prominent brownish yellow (10YR 6/6) mottles; moderate coarse columnar structure; very hard, very firm, very sticky and very plastic; common fine and very fine roots; common fine and very fine tubular pores; continuous thick very dark brown (10YR 2/2) moist clay films on faces of peds; slightly acid (pH 6.4); diffuse wavy boundary. (6 to 11 inches thick)

Bt2—26 to 33 inches (66 to 84 centimeters); light gray (10YR 7/2) and very pale brown (10YR 7/3) clay, grayish brown (10YR 5/2) moist; common medium prominent brownish yellow (10YR 6/6) mottles; moderate coarse prismatic structure; very hard, very firm, very sticky and very plastic; common fine and very fine roots; common fine and very fine tubular pores; continuous thick very dark brown (10YR 2/2), moist, clay films on faces of peds; slightly acid (pH 6.3); gradual wavy boundary. (0 to 10 inches thick)

Bt3—33 to 39 inches (84 to 99 centimeters); light gray (10YR 7/2) and very pale brown (10YR 7/3) clay, grayish brown (2.5Y 5/2) moist; common medium faint light brownish gray (10YR 6/2) mottles; massive; very hard, very firm, very sticky and very plastic; common fine and very fine roots; common fine and very fine tubular pores; continuous thick very dark brown (10YR 2/2), moist, clay films on faces of peds; slightly acid (pH 6.3); gradual wavy boundary. (0 to 10 inches thick)

C1—39 to 45 inches (99 to 114 centimeters); light gray (10YR 7/2) and very pale brown (10YR 7/3) sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, very sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; many thick colloidal films lining pores; few reddish yellow (7.5YR 7/6) and brownish yellow (10YR 6/6) weathered gravel; slightly acid (pH 6.2); gradual wavy boundary. (0 to 12 inches thick)

C2—45 to 57 inches (114 to 145 centimeters); variegated light gray (10YR 7/2) very pale brown (10YR 7/3) and yellow (10YR 7/6) sandy clay loam, grayish brown (2.5Y 5/2), brownish yellow (10YR 6/8), and yellowish brown (10YR 5/4) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; many very fine and fine tubular pores; many thick colloidal films lining pores; moderately acid (pH 6.0); gradual wavy boundary. (5 to 15 inches thick)

C3—57 to 63 inches (145 to 160 centimeters); variegated light gray (10YR 7/2), very pale brown (10YR 7/3), and yellow (10YR 7/6) sandy clay loam, grayish brown (2.5YR 5/2), brownish yellow (10YR 6/8), and yellowish brown (10YR 5/4) moist; massive; hard, friable, sticky and plastic; few fine roots; many fine and very fine tubular pores; common thick colloidal films lining pores; source of thin white (10YR 8/1) particles in horizon undetermined; moderately acid (pH 6.0).

Range in Characteristics

Solum thickness is 16 to 70 inches. The soil between depths of 6 and 20 inches is typically dry in all parts for at least 45 consecutive days between the beginning of July and mid-October and typically moist in all parts for more than 45 consecutive days between the end of December and the end of April. The mean annual soil temperature is about 59 to 61 degrees F. Organic matter content is more than 1 percent at a depth of 10 inches and less than 1 percent at a depth of 20 inches. Base saturation is more than 75 percent in all parts of the profile. Pebbles range from 0 to 7 percent, by volume.

The Ap or A horizon is very dark grayish brown, dark gray, dark grayish brown, brown, or grayish brown (10YR 3/2, 4/1, 4/2, 4/3, 5/3, or 5/2). Texture is sandy loam, loam, sandy clay loam, or clay loam. This horizon ranges from moderately acid to neutral.

The E horizon is light gray, light brownish gray, very pale brown, or white (10YR 6/1, 6/2, 7/1, 7/2, 8/1, 8/2, or 8/3). In some pedons, it has yellowish brown, light yellowish brown, strong brown, or light brown (10YR 5/4, 5/6, or 6/4 or 7.5YR 5/6 or 6/4) mottles with black (10YR 2/1) flakes and granules. Texture is sandy loam, loam, sandy clay loam, or clay loam. Reaction ranges from moderately acid to neutral.

The Bt horizon is brown, gray, light brownish gray, pale brown, light gray, or very pale brown (10YR 5/3, 6/1, 6/2, 6/3, 7/1, 7/2, or 7/3 or 2.5Y 6/2 or 7/2). Most horizons have mottles that are variegated in colors of yellowish brown, brownish yellow, yellow, brown, light brown, pink, yellowish red, or reddish yellow (10YR 5/4, 6/6, or 7/6; 7.5YR 5/4, 6/4, 7/4, or 8/4; or 5YR 4/6, 5/6, or 6/6). Texture is heavy clay loam or clay. Reaction ranges from moderately acid to moderately alkaline.

Some pedons have a BC horizon that is similar in color to the Bt horizon but lacks mottles with hue of 5YR. Texture is sandy clay loam or clay loam. This horizon ranges from moderately acid to moderately alkaline.

The C horizon is light gray, pale brown, very pale brown, yellow, light brown, or reddish yellow (2.5Y 7/2; 10YR 6/3, 7/2, 7/3, 7/4, 7/6, 8/3, or 8/4; or 7.5YR 6/4 or 7/6). Texture is typically sandy clay loam or clay loam, but strata of sandy loam may occur in some pedons. This horizon ranges from moderately acid to neutral.

Xerolls

Xerolls consist of deep, well drained soils that formed in residuum from serpentinite. These soils are on mountains. Slopes range from 15 to 30 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Xerolls

Typical Pedon

Xerolls; Santa Clara County, California; Almaden Quicksilver County Park, Hidalgo Cemetery Road, Hildago Cemetery, on a northeast-facing 30 percent slope under a cover of oaks, in a nonsectionized area of T. 9 S., R. 1 E.; at an elevation of 1,329 feet; UTM Zone 10, Northing 4114493, Easting 603342, NAD83; USGS quadrangle: Santa Teresa Hills, California. When described on August 30, 2006, the soil was dry throughout. (Colors are for dry soil unless otherwise noted.) This pedon is representative but not completely typical of the Xerolls in this survey area because of the highly variable nature of these soils.

Oi—0 to 2 inches (0 to 5 centimeters); slightly decomposed plant material, oak leaves and twigs.

A—2 to 7 inches (5 to 19 centimeters); brown (7.5YR 4/3), broken face, clay loam, dark brown (7.5YR 3/3), broken face, moist; 30 percent clay; strong coarse and strong medium subangular blocky structure; hard, very sticky and very plastic; 10 percent 2- to 75-millimeter rock fragments; slightly acid, pH 6.3 by pH meter 1:1 water; clear smooth boundary.

Bw1—7 to 20 inches (19 to 50 centimeters); dark brown (7.5YR 3/3), broken face, clay loam, brown (7.5YR 4/3), broken face, moist; 33 percent clay; massive; hard, very sticky and very plastic; 10 percent 2- to 75-millimeter rock fragments; slightly acid, pH 6.4 by pH meter 1:1 water; clear smooth boundary.

Bw2—20 to 33 inches (50 to 85 centimeters); dark brown (7.5YR 3/3), broken face, clay loam, brown (7.5YR 4/3), broken face, moist; 40 percent clay; massive; hard, very sticky and very plastic; 10 percent 2- to 75-millimeter rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

Bw3—33 to 46 inches (85 to 118 centimeters); strong brown (7.5YR 4/6), broken face, clay loam, strong brown (7.5YR 5/6), broken face, moist; 33 percent clay; massive; hard, very sticky and very plastic; 10 percent 2- to 75-millimeter rock fragments; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.
C—46 to 49 inches (118 to 125 centimeters); strong brown (7.5YR 4/6), broken face, very gravelly sandy loam, strong brown (7.5YR 5/6), broken face, moist; 18 percent clay; massive; slightly hard, slightly sticky and nonplastic; 35 percent 2- to 75-millimeter rock fragments; soft, highly weathered silica-carbonate and serpentine; slight effervescence, by HCl, 1 normal; slightly alkaline, pH 7.5 by pH meter 1:1 water; clear smooth boundary.
R—49 to 51 inches (125 to 130 centimeters); hard, fractured serpentinite.

Range in Characteristics

These soils are classified at the great group level due to the extreme variability of soil properties resulting from historic mining activities. Disturbance is extensive.

Depth to hard serpentinite is 100 to 150 centimeters or more in some areas. The soil moisture control section is dry in all parts from about June 1 to November 1 (about 130 days). The particle-size control section averages 30 to 35 percent clay and 10 to 15 percent rock fragments, mostly gravel. Mineralogy is magnesic. The soils are not calcareous but can have free carbonates in the zone just above the contact to bedrock; some areas developed on silica-carbonate parent materials and are calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 25 centimeters.

The A horizon has dry color of 10YR 5/3 or 7.5YR 4/3 and moist color of 10YR 3/3 or 7.5YR 3/3. Texture is loam or clay loam. Clay content ranges from 26 to 35 percent. Rock fragments range from 10 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.3.

The Bw horizon has dry color of 7.5YR 4/6, 4/3, or 3/3 or 2.5Y 5/2 and moist color of 7.5YR 4/6, 3/3, or 2.5/3 or 2.5Y 3/2. Texture is clay loam or clay. Clay content ranges from 28 to 40 percent. Rock fragments range from 10 to 15 percent gravel. Reaction ranges from pH 6.1 to 7.8.

The C horizon has dry color of 10YR 5/6, 7.5YR 5/6, or 2.5Y 5/2 and moist color of 10YR 4/6, 7.5YR 4/6, or 2.5Y 3/2. Texture is very gravelly sandy loam or extremely gravelly sandy clay loam. Clay content ranges from 10 to 27 percent. Rock fragments range from 35 to 55 percent gravel. Reaction ranges from pH 6.6 to 7.8.

Xerorthents, Anthropogenic Fill

Xerorthents, anthropogenic fill consist of very deep, well drained soils that formed in human-transported materials from various sources (fig. 79). These soils are on alluvial fans and in basins. Slopes range from 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Xerorthents

Typical Pedon

Xerorthents, anthropogenic fill; Santa Clara County, California; Waterford Park on Vistapark Drive, north of Capitol Expressway, San Jose, on the west side of the park, on a west-facing 2 percent slope under a cover of turf grasses, in a nonsectionized area of T. 7 S., R. 1 E.; at an elevation of 150 feet; UTM Zone 10, Northing 4126421, Easting 601432, NAD83; USGS quadrangle: San Jose East, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

Figure 79.—Example pedon of Xerorthents, anthropogenic fill. Photo was taken at a trench cut through a narrow garden bed, between a city street and a commercial parking lot in Santa Clara. The entire soil profile is transported soil material. The gray soil material from depths of 0 to 48 centimeters is clay and was formerly Hangerone soils. The layer has been mixed and has 10 percent gravel added. Between depths of 48 and 88 centimeters is gray sandy clay loam with about 15 percent gravel. Below a depth of 88 centimeters is gravelly sandy loam. Pipes are buried in this layer.

^A—0 to 2 inches (0 to 5 centimeters); dark grayish brown (10YR 4/2), broken face, sandy clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 25 percent clay; weak fine subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common very fine roots; many very fine interstitial pores; 5 percent angular very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary.

^C1—2 to 10 inches (5 to 25 centimeters); dark grayish brown (10YR 4/2), broken face, gravelly sandy clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 28 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine roots; common very fine interstitial pores; 60 percent clay films on all faces of peds; 15 percent angular very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

^C2—10 to 20 inches (25 to 50 centimeters); grayish brown (10YR 5/2), broken face, sandy clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 33 percent clay; weak medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine roots; common very fine interstitial pores; 70 percent clay films on all faces of peds; 10 percent

rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.6 by pH meter 1:1 water; abrupt smooth boundary.

^C3—20 to 30 inches (50 to 75 centimeters); yellowish brown (10YR 5/4), broken face, very gravelly sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 22 percent clay; massive; loose, loose, slightly sticky and slightly plastic; 50 percent angular very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.7 by pH meter 1:1 water; abrupt smooth boundary. (Note: Horizon has small pieces of concrete and some rounded fragments.)

^C4—30 to 39 inches (75 to 100 centimeters); light yellowish brown (10YR 6/4), broken face, gravelly sandy clay loam, dark yellowish brown (10YR 4/4), broken face, moist; 25 percent clay; weak medium subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common very fine interstitial pores; 30 percent clay films between sand grains; 20 percent rounded very strongly cemented 2- to 75-millimeter mixed rock fragments; slightly alkaline, pH 7.7 by pH meter 1:1 water. (Note: At a depth of 100 centimeters, cobbles or stones prevent further excavation.)

Range in Characteristics

These soils are classified at the great group level because of the extreme variability in soil characteristics of the human-transported materials. Buried A horizons occur in some areas within 150 centimeters of the soil surface.

The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts, unless irrigated, from about June 1 to October 15 (about 135 days). The particle-size control section averages 18 to 35 percent clay and 10 to 50 percent rock fragments, mostly gravel.

The A horizon has dry color of 10YR 5/1, 4/3, or 4/2 and moist color of 10YR 3/3, 3/2, or 3/1. Texture is sandy clay loam, loam, clay loam, gravelly loam, gravelly sandy clay loam, or gravelly clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 5 to 30 percent gravel. Reaction ranges from pH 6.6 to 8.4.

The C1 and C2 horizons have dry color of 10YR 6/3, 5/1, 4/3, or 4/2 and moist color of 10YR 4/3, 3/3, 3/2, or 3/1. Texture is sandy clay loam, loam, clay loam, gravelly loam, gravelly sandy clay loam, or gravelly clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 5 to 30 percent gravel. Reaction ranges from pH 6.6 to 8.4.

The C3 and C4 horizons have dry color of 10YR 6/4, 5/4, or 5/3 and moist color of 10YR 4/4, 4/3, or 3/3. Texture is gravelly sandy clay loam, gravelly loam, gravelly clay loam, very gravelly loam, very gravelly sandy clay loam, or very gravelly clay loam. Clay content ranges from 18 to 35 percent. Rock fragments range from 15 to 60 percent gravel. Reaction ranges from pH 6.6 to 8.4.

Xerorthents, Trash Substratum

Xerorthents, trash substratum consist of very deep anthropogenic soils overlying compacted trash that formed in human-transported and compacted materials from mixed sources. These soils are on closed, covered dumps in marshes (fig. 80). Slopes range from 0 to 50 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 60 degrees F.

Taxonomic Classification

Xerorthents

Typical Pedon

Xerorthents, trash substratum, 15 to 30 percent slopes; Santa Clara County, California; Shoreline Park, City of Mountain View, on the hill east of the overflow parking area,

Figure 80.—Landscape of Xerorthents, trash substratum. Photo was taken near the Shoreline Pavilion in Mountain View. These areas have trash at the edge of the filled marsh. The trash is mounded into a hill, covered with fill material, and used for recreation and wildlife habitat. Soil materials used to cover the trash are variable in texture. Because of safety concerns due to methane from decaying trash, excavations were very limited in these soils.

on an east-facing 15 percent slope under a cover of annual grasses and forbs, in a nonsectionized area of T. 6 S., R. 2 W.; at an elevation of 24 feet; UTM Zone 10, Northing 4143077, Easting 581864, NAD83; USGS quadrangle: Mountain View, California. When described, the soil was slightly moist throughout. (Colors are for dry soil unless otherwise noted.)

Oi—0 to 2 inches (0 to 4 centimeters); slightly decomposed plant material; abrupt smooth boundary.

^A—2 to 10 inches (4 to 25 centimeters); light olive brown (2.5Y 5/3), broken face, loam, olive brown (2.5Y 4/3), broken face, moist; 25 percent clay; strong fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; moderately alkaline, pH 8.0 by pH meter 1:1 water; abrupt smooth boundary.

^C1—10 to 19 inches (25 to 47 centimeters); light olive brown (2.5Y 5/3), broken face, clay loam, olive brown (2.5Y 4/3), broken face, moist; 32 percent clay; strong fine subangular blocky structure; hard, friable, moderately sticky and moderately plastic; moderately alkaline, pH 8.0 by pH meter 1:1 water; abrupt smooth boundary.

^C2—19 to 29 inches (47 to 73 centimeters); light yellowish brown (2.5Y 6/3), broken face, clay loam, olive brown (2.5Y 4/3), broken face, moist; 32 percent clay; strong fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; slightly alkaline, pH 7.8 by pH meter 1:1 water; abrupt smooth boundary.

^C3—29 to 33 inches (73 to 85 centimeters); very dark grayish brown (10YR 3/2), broken face, clay loam, very dark grayish brown (10YR 3/2), broken face, moist; 35 percent clay; strong fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; abrupt smooth boundary.

^C4—33 to 52 inches (85 to 133 centimeters); brown (10YR 4/3), broken face, sandy clay loam, brown (10YR 4/3), broken face, moist; 28 percent clay; strong fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; abrupt smooth boundary.
^2Cdu—52 to 59 inches (133 to 150 centimeters); black (10YR 2/1), broken face, slightly decomposed plant material, black (10YR 2/1), broken face, moist.

Range in Characteristics

Depth to the ^2Cdu horizon, buried trash, is 80 to 160 centimeters. The mean annual soil temperature is 62 to 64 degrees F. The soil moisture control section is dry in all parts from about June 1 to October 15 (about 135 days). The particle-size control section averages 30 to 40 percent clay and 0 to 10 percent rock fragments, mostly gravel. Mineralogy is mixed.

The ^A horizon has dry color of 10YR 6/4 or 4/2 or 2.5Y 5/3 and moist color of 10YR 4/4 or 3/2 or 2.5Y 4/3. Texture is sandy clay loam or loam. Clay content ranges from 30 to 35 percent. Rock fragments range from 0 to 10 percent gravel. Reaction ranges from pH 7.3 to 8.0.

The ^C horizon has dry color of 10YR 6/4, 6/3, 5/4, 5/3, 5/1, 4/3, or 4/1 or 2.5Y 6/3 or 5/3 and moist color of 10YR 4/4, 4/3, 3/2, or 2/1 or 2.5Y 4/3 or 3/1. Texture is sandy clay loam, clay loam, silty clay loam, or clay. Clay content ranges from 30 to 40 percent. Rock fragments range from 0 to 20 percent gravel. Reaction ranges from pH 7.6 to 8.0.

The ^2Cdu horizon is compacted trash.

Zamora Series

The Zamora series consists of very deep, well drained soils that formed in alluvium from mixed sedimentary rocks. Zamora soils are on alluvial fans and terraces and have slopes of 0 to 9 percent. The mean annual precipitation is about 25 inches, and the mean annual air temperature is about 60 degrees F.

Taxonomic Classification

Fine-silty, mixed, superactive, thermic Mollic Haploxeralfs

Typical Pedon

Zamora silt loam, 2 to 9 percent slopes; Santa Clara County, California; about 30 feet southwest of the intersection of Bowden Avenue and Watsonville Road, in a prune orchard; USGS quadrangle: Morgan Hill, California. (Note: The exact location has been obscured by road building and other anthropogenic alterations.) WGS84 location estimated using Google Earth and ArcGIS: 37.0872500 -121.6537417. (Colors are for dry soil unless otherwise noted.)

Ap—0.0 to 7.1 inches (0 to 18 centimeters); dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, very sticky and very plastic; many very fine roots; many very fine interstitial pores; neutral, pH 7.0; abrupt smooth boundary.
A—7.1 to 15.0 inches (18 to 38 centimeters); dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, very sticky and very plastic; many very fine and common medium roots; neutral, pH 7.0; clear smooth boundary.
Bt1—15.0 to 26.0 inches (38 to 66 centimeters); brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, very sticky and very plastic; few very fine and few medium roots; common very fine tubular and common very fine interstitial pores; clay films on all faces of peds and clay films on surfaces along pores; neutral, pH 7.0; clear wavy boundary.

Bt2—26.0 to 35.0 inches (66 to 89 centimeters); brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, very sticky and very plastic; few very fine interstitial and few very fine and medium tubular pores; clay films on surfaces along pores and reddish yellow (7.5YR 6/6), dry, and strong brown (7.5YR 5/6), moist, clay films on all faces of peds; yellowish brown (10YR 5/4), dry, and dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; neutral, pH 7.0; clear smooth boundary.

C1—35.0 to 57.9 inches (89 to 147 centimeters); brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, very sticky and very plastic; few very fine interstitial and few very fine tubular pores; neutral, pH 7.0; clear wavy boundary.

C2—57.9 to 70.1 inches (147 to 178 centimeters); pale brown (10YR 6/3) gravelly sandy clay loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; very few very fine and very few fine interstitial pores; 30 percent strongly cemented 2- to 75-millimeter rock fragments; neutral, pH 7.0.

Range in Characteristics

The solum ranges in thickness from 35 to 46 inches. The mean annual soil temperature ranges from about 59 to 64 degrees F. These soils are continually moist to depths between 4 and 12 inches from sometime in November until April or May and dry the remainder of the year.

The A horizon is dark grayish brown, grayish brown, dark brown, or brown; hue is 10YR or 2.5Y. Texture is fine sandy loam, loam, silt loam, or light silty clay loam. The surface layer is both hard or very hard and massive when dry. The horizon is about 2 to 4 percent organic matter. Reaction is slightly acid or neutral.

The Bt horizon is dark grayish brown or brown; hue is 10YR or 7.5YR and chroma is 2 or 3. Texture is clay loam or silty clay loam that contains less than 15 percent materials coarser than very fine sand. The upper boundary is diffuse, gradual, or clear, and some pedons have a transitional AB horizon or BA horizon. The Bt horizon has about 6 to 10 percent more clay absolute than the A horizon but averages slightly less than 35 percent total clay. Structure is either massive or blocky. Reaction is neutral or slightly alkaline.

The C horizon is brown, grayish brown, yellowish brown, pale brown, light yellowish brown, or light olive brown. It has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2, 3, or 4. Texture is clay loam, silt loam, loam, sandy loam, or gravelly loam. In some pedons, the lower part of the horizon is stratified. The C horizon ranges from neutral to moderately alkaline. In some pedons it contains segregated lime, and in others it lacks it.

Zayante Series

The Zayante series consists of very deep, somewhat excessively drained sandy soils that formed in weakly consolidated marine sediments. Zayante soils are on hills and have slopes of 5 to 75 percent. The mean annual precipitation is about 52 inches, and the mean annual air temperature is about 54 degrees F.

Taxonomic Classification

Sandy, mixed, mesic Humic Dystrustepts

Typical Pedon

Zayante coarse sand; Santa Cruz County, California; about 1.6 miles (straight line) west of the intersection of Glen Canyon and Mt. Herman Roads in Scotts Valley, about 1,000 feet north of Lockwood Lane and 100 feet west of Graham Hill Road, under tree and brush cover, in section 23 (projected), T. 10 S., R. 2 W.; lat. 37 degrees 1

minute 50 seconds N. and long. 122 degrees 1 minute 55 seconds W., NAD27; USGS quadrangle: Felton, California. (Colors are for dry soil unless otherwise noted.)

A1—0 to 10 inches (0 to 25 centimeters); dark gray (10YR 4/1) coarse sand, very dark brown (10YR 2/2) moist; single grained; loose; many fine roots; many very fine and fine interstitial pores; strongly acid (pH 5.5); clear wavy boundary. (10 to 20 inches thick)

A2—10 to 20 inches (25 to 51 centimeters); dark grayish brown (10YR 4/2) coarse sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; common fine roots; many fine and very fine interstitial pores; moderately acid (pH 5.6); gradual wavy boundary. (4 to 12 inches thick)

A3—20 to 30 inches (51 to 76 centimeters); grayish brown (10YR 5/2) coarse sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; common fine roots; many fine and very fine interstitial pores; moderately acid (pH 5.6); gradual wavy boundary. (0 to 14 inches thick)

C1—30 to 48 inches (76 to 122 centimeters); light brownish gray (10YR 6/2) coarse sand, brown (10YR 4/3) moist; massive; soft, very friable; few fine roots; many very fine and fine interstitial pores; moderately acid (pH 5.7); gradual wavy boundary. (14 to 20 inches thick)

C2—48 to 60 inches (122 to 152 centimeters); very pale brown (10YR 7/3) coarse sand, pale brown (10YR 6/3) moist; massive; soft, very friable; few coarse roots; many fine and very fine interstitial pores; neutral (pH 7.0).

Range in Characteristics

Depth to a paralithic contact is more than 80 inches. The mean annual soil temperature at a depth of 20 inches is about 56 degrees F. The average summer soil temperature is about 60 degrees F, and the average winter temperature is about 46 degrees F. The soils are moist in some or all parts between depths of 12 and 35 inches from mid-November until late May. Base saturation is less than 50 percent in some part below the base of the mollic epipedon and above 1 meter.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, grayish brown, or brown with hue of 10YR or 2.5Y. Moist value is 3 or less. Texture ranges from sand to loamy fine sand. Reaction is strongly acid or moderately acid (pH 5.5 to 6.0). Organic matter is more than 1 percent below a depth of 20 inches.

The C horizon is dark grayish brown to pink, pinkish gray, or very pale brown (10YR 4/2, 5/2, 5/3, 6/2, 6/3, 7/2, or 7/3 or 7.5YR 4/2, 5/2, 6/2, 7/2, 5/4, 6/4, or 7/4). Texture ranges from coarse sand to loamy fine sand. Reaction is typically moderately acid but ranges from very strongly acid to neutral. Sediments in the substrata are loose to softly consolidated and consist of variably gravelly sand to loamy fine sand.

Zeppelin Series

The Zeppelin series consists of deep, well drained soils that formed in residuum from sandstone (fig. 81). Zeppelin soils are on hills (fig. 82). Slopes range from 5 to 30 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 59 degrees F.

Taxonomic Classification

Fine, smectitic, thermic Pachic Argixerolls

Typical Pedon

Zeppelin very fine sandy loam in an area of Zeppelin-McCoy complex, 15 to 30 percent slopes; Santa Clara County, California; Stanford University Academic Preserve, west of a large satellite dish, south and west of the recreation trail to a creek, on a north-facing 13 percent slope under a cover of annual grasses and forbs,

Figure 81.—Representative profile of the Zeppelin series. This soil has a thick A horizon of dark grayish brown very fine sandy loam or loam extending to a depth of 48 centimeters. Strongly expressed Bt and BCt horizons of clay occur at depths of 48 to 100 centimeters. A paralithic contact of weathered sandstone is at a depth of 100 centimeters. This sandstone weathers rapidly. The soil has few rock fragments and abundant clay.

in a nonsectionized area of T. 6 S., R. 3 W.; at an elevation of 420 feet; UTM Zone 10, Northing 41406616, Easting 572210, NAD83; USGS quadrangle: Palo Alto, California. When described, the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

A1—0 to 2 inches (0 to 6 centimeters); dark grayish brown (10YR 4/2), broken face, very fine sandy loam, very dark brown (10YR 2/2), broken face, moist; 18 percent clay; moderate medium subangular blocky structure; slightly hard, very friable,

Figure 82.—Landscape of Zeppelin and McCoy soils. Photo was taken on the Stanford University Academic Preserve looking south across Page Mill Road. Zeppelin and McCoy soils are on the rolling hills in the foreground. Los Altos Hills and Santa Cruz Mountains are in the background.

slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt smooth boundary.

A2—2 to 7 inches (6 to 19 centimeters); dark grayish brown (10YR 4/2), broken face, loam, very dark brown (10YR 2/2), broken face, moist; 21 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky and slightly plastic; common very fine roots; many very fine interstitial pores; slightly acid, pH 6.4 by pH meter 1:1 water; abrupt smooth boundary.

ABt—7 to 19 inches (19 to 48 centimeters); dark grayish brown (10YR 4/2), broken face, loam, very dark grayish brown (10YR 3/2), broken face, moist; 25 percent clay; moderate medium subangular blocky structure; slightly hard, very friable, moderately sticky and moderately plastic; common very fine roots; many very fine tubular pores; 90 percent clay films on all faces of peds; slightly acid, pH 6.5 by pH meter 1:1 water; abrupt smooth boundary.

Bt—19 to 30 inches (48 to 77 centimeters); dark grayish brown (10YR 4/2), broken face, clay, very dark grayish brown (10YR 3/2), broken face, moist; 40 percent clay; weak medium subangular blocky structure; hard, firm, moderately sticky and very plastic; common very fine tubular pores; 60 percent clay films on all faces of peds; slightly acid, pH 6.6 by pH meter 1:1 water; clear smooth boundary.

BCt—30 to 39 inches (77 to 100 centimeters); 10 percent dark grayish brown (2.5Y 4/2), broken face, and 90 percent light olive brown (2.5Y 5/3), broken face, clay, 10 percent very dark grayish brown (2.5Y 3/2), broken face, moist and 90 percent olive brown (2.5Y 4/3), broken face, moist; 40 percent clay; moderate coarse subangular blocky structure; hard, friable, moderately sticky and very plastic; common very fine tubular pores; 80 percent clay films on all faces of peds; neutral, pH 6.8 by pH meter 1:1 water; abrupt smooth boundary.

Cr—39 to 43 inches (100 to 110 centimeters); moderately cemented, slightly hard, very fine grained sandstone.

Range in Characteristics

Depth to weakly cemented sandstone is 100 to 126 centimeters. The mean annual soil temperature is 60 to 62 degrees F. The soil moisture control section is dry in all parts from about May 1 to November 1 (about 180 days). The particle-size control section averages 35 to 45 percent clay and 0 to 20 percent rock fragments, mostly gravel. Mineralogy is mixed. The soils are not calcareous. Organic matter content ranges from 1 to 3 percent to a depth of 20 centimeters.

The A horizon has dry color of 10YR 5/4, 5/3, 5/1, or 4/2 and moist color of 10YR 3/4, 3/3, 3/2, or 2/2. Texture is very fine sandy loam, fine sandy loam, or loam. Clay content ranges from 12 to 25 percent. Rock fragments range from 0 to 5 percent gravel. Reaction ranges from pH 5.6 to 6.6.

The Bt and BCt horizons have dry color of 10YR 6/4, 5/6, 5/2, or 4/4 or 2.5Y 7/3, 6/3, 5/3, or 4/2 and moist color of 10YR 4/6, 4/4, 4/2, or 3/2 or 2.5Y 5/3, 4/3, or 3/2. Texture is clay, sandy clay, or clay loam. Clay content ranges from 35 to 45 percent. Rock fragments range from 0 to 20 percent gravel. Reaction ranges from pH 5.6 to 6.6.

Formation of the Soils

This section describes the factors of soil formation and how they relate to the soils in the survey area and the geomorphic surfaces of the area.

Factors of Soil Formation

Dr. Hans Jenny of the University of California at Berkeley published his book "Factors of Soil Formation" in 1941. Jenny's five soil-forming factors are still considered essentially the unaltered fundamentals of soil formation. The soil-forming factors are climate, organisms, time, parent material, and aspect or topography. In the Santa Clara Valley, parent material, climate, and time are the dominant factors in the formation of area soils. In the Santa Cruz Mountains and foothills and the Diablo Ranges, aspect and organisms play a much stronger role. In the northwestern part of Santa Clara County, all five soil-forming factors are at work and vary largely based on major landform areas.

Climate

Heat and moisture greatly influence soil formation. Warming of the soil by the sun induces plant growth where there is sufficient moisture, and roots penetrate and affect soil structure and organic matter content. Moisture from rainfall helps to break down rocks and soil particles to finer sizes. Plant nutrients are made soluble and moved within root zones. Water moves clay particles from A horizons and deposits them in B horizons with the passage of sufficient time, creating argillic horizons. The weathering of parent materials by chemical and physical processes takes place in all but the driest months of the year.

The Santa Clara Valley has a very mild and gentle climate. Rainfall is spread through the late fall to late spring months and is very effective at supplying soil moisture for soil weathering and plant growth, retaining nutrients for plant growth, and limiting excessive leaching to only the sandiest of soils, such as Elder and Caninecreek. Native plant growth was sufficient to produce thick, dark A horizons in most of the soils of the Santa Clara Valley, many of which fall into the Pachic taxonomic subgroup defining soils with A horizons thicker than 50 centimeters. Soils in the Pachic subgroup are Botella, Campbell, Caninecreek, Elder, Flaskan, Elpaloalto, Newpark, Stevenscreek, and Still. In the Santa Clara Valley, summer and early fall are conditioned by cool winds blowing south from the San Francisco Bay. These cool winds limit high temperatures to the upper 70s or low 80s and allow the soils to retain moisture longer into the summer for plant growth; soils are not completely dry until midsummer. Basin areas of the lower Santa Clara Valley receive abundant moisture from rainfall and runoff. This combined with poor drainage and high water tables under natural conditions formed very dark A horizons with high organic matter content.

Under natural conditions, before the construction of flood-control structures began in the 1930s, streams flowing into the Santa Clara Valley would periodically overflow and spread floodwaters across the flood plains and alluvial fans. This additional

moisture in the soils contributed to the growth of grasses and trees, increasing the deposition of organic matter into the soils.

On the upper alluvial fan terraces and uplifted terraces near the base of the Santa Cruz Mountains, soils with clayey subsoils that retain moisture (such as Literr, Merbeth, and Montavista) also developed thick A horizons. These thick A horizons are somewhat unusual for older terrace soils; over time, A horizons typically diminish in thickness while B horizons accumulate more clay and thicken.

Precipitation increases from the lower edge of the foothills of the Santa Cruz Mountains to the summit areas of Umunhum and Loma Prieta and areas along the survey and county boundary along Skyline Boulevard. As altitude increases, soil moisture increases, favorably affecting plant growth. More trees and shrubs supply more organic matter to the soil. Southern aspects remain hot and dry (see following section on aspect). Because of the increase in moisture and cooler temperatures, soil weathering can proceed until late summer in the mountains.

Weathering in the mountain soils is a process of hydrolysis. Bases and organic acids are leached from the O and A horizons into the B horizons and further downward, leading to an acid soil reaction in B and C horizons. Soils on the Franciscan Formation east of the San Andreas Fault commonly have a pH of 5.5. West of the San Andreas Fault, Ben Lomond soils commonly have a pH of around 5.0.

The Santa Cruz Mountains and foothills receive increasing amounts of moisture with increasing elevation, and the Diablo Ranges experience a similar but less pronounced effect. Because soil moisture is deficient for a shorter period of time during late summer and early fall, trees have more time to grow. Many of the soils in these areas, such as Ben Lomond, Footpath, Kawenga, and Mouser, also have thick, dark A horizons. Soil temperatures drop slightly in the mountains with increasing elevation but do not become low enough to hinder tree growth. This is partially due to the moderating effects of the Pacific Ocean.

Organisms

Plants exert a strong influence on the development of soils. Organic matter accumulates at the surface of soils as plants shed leaves and branches. Organic materials decompose, enter the soil, and accumulate in the A horizons. Novato soils in the San Francisco Bay marsh have high amounts of organic matter in the surface horizon because aquatic plants provide high deposits and aerobic decomposition does not function in the tidal environment. Adjacent to the marsh on the drier bank, soils (such as Embarcadero soils) are high in salt and do not have dense vegetation. In these soils, aerobic decomposition functions to decompose organic matter.

The basin soils Hangerone and Clear Lake developed thick grass and bush or vine vegetation and were flooded periodically during winter. This allowed the production of a lot of organic matter and raised organic matter levels in the soils. These soils have characteristically dark-colored A and B horizons. On alluvial fans and flood plains, original vegetation was oaks with an understory of grasses, forbs, poison oak, berry vines, etc. Soils in these areas received large amounts of organic matter from decomposing plant matter; most soils are darkened to a depth of 50 centimeters or more. This organic matter, combined with a texture ideal for plants, is one reason for the excellent condition of these soils for agriculture in the late 19th and early 20th centuries. Good examples of these soils are Flaskan, Botella, Campbell, and Elder.

The fine root systems of grasses are particularly effective at leaving organic matter deep and finely dispersed in the profile as the roots decay. Even soils on the higher terraces of the Santa Clara Valley have a high organic matter content in the surface layer.

In the Santa Cruz Mountains, the forest of Douglas fir, California bay laurel, tanoak, and red barks produces a large amount of litter each year. This litter decomposes and adds organic matter to the soils. Soils in these areas include Ben Lomond, Felton, and

Mouser, which have thick dark A horizons. In contrast, on steep south-facing slopes, brush species such as chaparral do not leave much litter on the ground and soils in these areas (such as Maymen) have a much lower content of organic matter. The forest canopy also is effective in reducing the amount of solar radiation and heating of the soils. This reduces evapotranspiration of soil moisture, leaving more moisture for a longer growing season. In contrast, on south slopes, much solar radiation and heating dry the soils and the growing season is much shorter. The situation is similar in the Diablo Ranges under oak forest on north slopes.

Organisms that live or burrow in the soils, such as worms, gophers, squirrels, and insects, improve the texture of soils by loosening particles and improving aeration. Worms in particular are found in soils that have a good moisture supply; they enhance the soil properties by tunneling and depositing digested material. Bacteria and fungi in soils are also very important. They are decomposers, breaking down organic materials to make them available as plant nutrients.

Time

Time has a less dramatic effect on soils than some of the other soil-forming factors, but soils can be significantly changed with the passage of long periods of time. Soil morphology is changed as clays are leached out of A horizons and deposited in B horizons, creating argillic horizons; rocks and fragments are broken down into smaller particles; soluble compounds such as calcium carbonate can be deposited in subsoil layers; and structure can become well defined.

Soils of recent Holocene age have had additions of organic matter to the A horizons but also many other changes. An example is Elder soils, which occur in the immediate vicinity of stream channels. Campbell soils, which also occur on lower flood plains near streams, have somewhat finer sediments and, in some places, bury older soils containing more clay. These soil materials typically are less than a few hundred years old.

Almost as young are the soils in basins. These soils are deposited by streams carrying fine textured alluvium. Basin soils such as Hangerone and Clear Lake do not have strongly developed horizons, although carbonates have accumulated in lower horizons due to historic water tables.

In general, soils on alluvial fans are young with weakly developed soil morphology. For example, Stevenscreek and Elpaloalto soils have only weakly expressed B horizons. Further up on the alluvial fans and some distance from the streams, the alluvium is older, perhaps dating to the middle Holocene (a few thousand years ago). Soils in these areas include Flaskan and Botella soils, which have argillic horizons.

Soils on the older terraces, such as Montavista and Tarasoga, may date to the early Holocene or late Pleistocene. They have argillic horizons that are well expressed with a high clay content and reddish brown colors. Older fragments are decomposing in place, and the once level surface has been eroded into rolling hills.

Soils on foothills and mountains have a more complex relationship to time due to slope. Erosion is more rapid on steeper slopes, keeping soils from developing and removing soil materials from the surface. Mass movement occurs on steep slopes and can remove the entire soil profile down to bedrock. Most mountain soils are old enough to develop B horizons with an accumulation of clay if slopes are not too steep. An example of older, more developed soils on ridges with slopes of less than 30 percent is Katykat soils, which have clay loam B horizons, reddish brown colors, and decomposing rock fragments. Soils such as Ben Lomond are generally on steep slopes and have weakly expressed B horizons.

At some point in time, soils may reach an equilibrium, that is, they have had enough time to develop until no further soil development can occur without a change in one of the soil-forming factors. In the Santa Clara area, the soils are generally precluded from

achieving this state due to geological activity, with active uplift and earthquakes, plus mass movement and fires that occur on a regular basis.

Parent Material

Parent material is a major factor in soil formation. It provides the basic structural materials of the soil mass for soil development. Alluvium is deposited along streams and rivers in valleys (see the following section on geomorphic surfaces for more information). Deposited alluvium then begins to weather in place. Chemical and physical processes weather soil particles into clay, a process that takes considerable time. In the Santa Clara Valley, several major streams, Coyote Creek from the Diablo Ranges, the Guadalupe River from the Santa Cruz Mountains, and other major streams such as Los Gatos Creek, Saratoga Creek, Stevens Creek, and San Francisquito Creek have all delivered large amounts of alluvium to the valley. The nature of this alluvium has changed with time. Pleistocene alluvial deposits are gravelly in nature. They have some cobbles and are generally poorly sorted. Botella and Flaskan soils developed in these deposits. Newer Holocene alluvial deposits are generally well sorted, although they contain gravel in many areas.

In the Santa Cruz Mountains, the Diablo Ranges, and foothill areas, bedrock is weathered by chemical and physical processes. The Franciscan Formation is dominated by sandstone, mudstone, and greenstone. Generally, these materials are hard but highly fractured, which allows tree roots and moisture to enter and begin the weathering process. Weathering occurs rapidly because of the abundant moisture, especially on north- and east-facing slopes. Soils develop to a depth of more than 5 feet in some areas.

Serpentinitic materials occur in the foothills of the Diablo Ranges and the Santa Cruz Mountains. These materials are hard and contain high amounts of magnesium, in relation to calcium, which limit the growth of vegetation. Weathering of these parent materials probably continues at a slower rate than those of non-serpentinitic materials. Most areas of this parent material are at the lower elevations of foothills and receive less rainfall. This combined with other factors produces mostly shallow soils.

Aspect or Topography

Slope orientation or aspect is a major soil-forming factor in the foothills and mountains of the Santa Clara Area. South- and southwest-facing slopes receive a lot of direct solar radiation and heat, which dry soils quickly and limit plant growth to brush or grass. On these slopes, soil temperatures are higher than on north-facing slopes. On north- and east-facing slopes, less direct solar radiation is received. Because of this and the forest canopy, cooler soil temperatures prevail and loss of soil moisture is reduced, allowing deeper soils to develop.

Slope steepness plays a role in erosion and mass movement. Slopes of more than 30 percent can be unstable under certain conditions, and slopes of more than 50 percent are even more likely to become unstable after an event such as extended heavy rainfall or an earthquake.

On alluvial fans, the steeper parts with slopes of more than 5 percent may have extensive bank erosion along stream channels due to the relatively soft nature of alluvial materials. On the lower alluvial fans and in basins, topography affects the collection of flood water and the levels of ground-water tables in soils under natural conditions.

Geomorphic Surfaces

A geomorphic surface is a mappable area of the earth’s surface that was formed by a specific set of processes during an certain episode of landscape evolution. Geomorphic surfaces are readily identifiable landforms used in soil mapping to locate

similar soils on similar landforms. They are most evident and useful on alluvial fans, flood plains, and terraces and in basins. Geomorphic surfaces can be constructional, such as alluvium deposited along streams, or erosional, such as the eroded surface of older stream terraces.

The sequence of geomorphic surfaces is described from the newest and usually the youngest surface to the highest and usually oldest. In the Santa Clara Valley, this ranges from the stream channel area to the highest terraces west of Cupertino. Geomorphic surfaces are not generally mapped in mountains and foothills, except in mountain valleys. Some areas of foothills may appear to the casual observer to be simply hills but are actually severely eroded or dissected alluvial terraces, containing alluvium and rounded and subrounded fragments from stream transport.

The first and youngest geomorphic surface is the stream channel, including the associated beaches, bars, and water. Deposition and erosion are both active during flooding. The variability of deposited materials is high; sands and fragments are mixed. Sand and gravel bars may be deposited and then eroded by the dynamic nature of the stream. Soils in this environment generally classify in the Aquents and Fluvents suborders of the Entisols order. Textural families range from sandy to sandy-skeletal with more than 35 percent rock fragments. Soils are typically stratified with layers of deposition having different textures and fragment content. Vegetative cover varies from none (on bare beaches and gravel bars) to dense willows, berry vines, cottonwoods, and aquatic plants. The vegetated areas are long and very thin and are commonly not mappable at the scale used in the soil survey. Many streams are controlled in the Santa Clara Valley, which greatly reduces the deposition and flooding that occurs along the streams under natural conditions. The age of the first surface is very young, less than 100 years.

The second geomorphic surface is the flood plain that is just a few feet higher than the first surface of the stream channels. Under natural conditions this surface is not flooded repeatedly, although floodwaters did flow across the second surface during larger storms or periods of extended wet weather. Relict back channels occur in some areas. Today, many areas of the second geomorphic surface in the Santa Clara Valley are protected from flooding and deposition by upstream dams and levees along the lower reaches of the streams. Soils on the second surface are Elder, Caninecreek, Landelspark, and Still. Elder soils have thick, dark deposits of sandy loam. Caninecreek soils are similar but have very gravelly textures below a meter. Landelspark soils have coarse stratification and a buried soil in the soil profile; they are loamy to sandy above the buried soil. Still soils are sandy loam and loam. These soils are very productive agricultural soils that have a high organic matter content. They were highly prized during the agricultural period before urbanization in the northern Santa Clara Valley. Native vegetation was a dense cover of oaks, California sycamore, poison oak, berry vines, grasses, and forbs. This surface occurs along existing streams, and in some areas branches away from the main stream area along relict channels. The age of the second surface is late Holocene, possibly several hundred years in age.

The third geomorphic surface is more extensive than the first two, occurring on a slightly higher flood plain and alluvial fan. This geomorphic surface is flooded occasionally during intense storms, which usually deposit finer soil materials such as silt loam and loam. This third surface is smooth in character. Under natural conditions, floodwaters moved slower and deposited finer sediments across the surface. This surface occurs in larger areas and can be some distance from the channel that deposited and flooded it. Soils on the third surface are Elpaloalto, Newpark, and Stevenscreek. Organic matter is high in these soils due to flooding and vegetation under natural conditions, but textures are finer than on the second surface. Elpaloalto soils are fine-silty, Newpark soils are fine-loamy with accumulations of carbonates, and

Stevenscreek soils are fine-loamy with weak subsoil development. These soils were very productive for agricultural uses. The third surface is mid-Holocene in age.

The fourth geomorphic surface differs substantially from the first three, generally occurring from 10 to about 30 feet higher than the first three surfaces on alluvial fans. Deposition no longer occurs as the streams are incised into the alluvial fan possibly caused by tectonic uplift. The fourth geomorphic surface occurs extensively in the Santa Clara Valley on the upper half of alluvial fans. Soils on the fourth surface are Flaskan and Botella. Flaskan soils are fine-loamy with a very gravelly substratum, and Botella soils are fine-loamy. Both soils have a well developed argillic horizon in the subsoil and a good supply of organic matter from the native vegetation of oaks and grasses. This surface is older than the first three, probably dating to the early Holocene.

The fifth geomorphic surface is markedly different from the fourth. It is substantially older and geologically uplifted and eroded and occurs on rounded and gently rounded low hills at the margins of the Santa Clara Valley. This surface may be as much as 100 feet above the fourth surface. Montavista and Tarasoga soils occur on this surface. These soils are well developed because of their age. Montavista soils have clay argillic horizons in the subsoil. Tarasoga soils developed from coarse gravelly material but have developed a strong argillic horizon in the subsoil. These soils have a good supply of organic matter in the A horizons due to the native vegetation of grasses and scattered oaks and the mild Santa Clara climate. Most of the soils on the fifth surface probably predate the Holocene and were deposited in the late Pleistocene.

The sixth and oldest surface in the Santa Clara Area is not readily identifiable. This surface occurs on foothills of the Santa Cruz Mountains west of Cupertino. On close examination, soils on this surface have alluvial materials visible in the substratum and contain rounded rock fragments from deposition on alluvial fans. Tectonic uplift has raised this surface to an elevation of more than 1,000 feet on some ridges. Erosion has played a large role in shaping this surface. Slopes range from 15 to 50 percent, and there is very little of the original flat alluvial surface left. This surface dates to the Pleistocene; there has been plenty of time for the effects of uplift and erosion. Several soils on this surface have been identified: Literr, Merbeth, Airship, and Minlum. Literr soils are strongly developed with fine textured argillic horizons and alluvium in the substratum. Merbeth soils are strongly developed with fine textured subsoils that continue to a depth of more than 60 inches. Airship soils occur on the steepest slopes where erosion is removing soil material. They are loamy-skeletal Inceptisols with little soil development. Minlum soils formed in colluvium on lower side slopes. They are fine-loamy with argillic horizons in the subsoil.

References

Jacobson, Yvonne. 1984. Passing farms: Enduring values.

Jenny, Hans. 1941. Factors of soil formation.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and W.D. Broderson (editors). 2002. Field book for describing and sampling soils, version 2.0. United States Department of Agriculture, Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

United States Department of Agriculture, Agricultural Research Center. 1978. Predicting rainfall-erosion losses: A guide to conservation planning. Agriculture Handbook No. 537.

United States Department of Agriculture, Natural Resources Conservation Service. 1996. Soil survey laboratory methods manual. Soil Survey Investigations Report 42.

United States Department of Agriculture, Natural Resources Conservation Service. 1997. National range and pasture handbook. Available at http://www.glti.nrcs.usda.gov/technical/publications/nrph.html

United States Department of Agriculture, Natural Resources Conservation Service. 1998. National forestry manual. Available at http://soils.usda.gov/technical/nfmanual/

United States Department of Agriculture, Natural Resources Conservation Service. 2001. National forestry handbook. Available at http://soils.usda.gov/technical/nfhandbook/

United States Department of Agriculture, Natural Resources Conservation Service. 2002. The PLANTS database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

United States Department of Agriculture, Soil Conservation Service. 1981. Land resource regions and major land resource areas of the United States. United States Department of Agriculture Handbook 296.

Glossary

AASHTO classification. A system that classifies soils specifically for geotechnical engineering purposes that is related to highway and airfield construction. It is based on particle-size distribution and Atterberg limits.

AASHTO Group Index (GI). An empirical index number used to evaluate clay and silty clay materials.

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Acid sulfate soils. Naturally occurring soils, sediments, or organic substrates such as peat that form under saline waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. Undisturbed below water, these soils are known as potential acid sulfate soils and do not have acid properties. However upon draining and drying, acid sulfate soils develop a soil pH commonly less than 4. Sulfuric acid is produced and released, making these soils totally unproductive and damaging to structures. The sulfuric acid releases other soil compounds such as aluminum and metals that can cause further damage. They occur in saline estuaries, marshes, and swamps.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone. See Alluvial fan.

Alluvial fan. A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone. The materials are deposited by a stream at the place where it issues from a narrow mountain valley or where a tributary stream is near or at its junction with the main stream. An alluvial fan is steepest near its apex that points upstream and slopes gently and convexly outward with a gradual decrease in gradient.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aridic moisture regime. In the aridic moisture regime, soils are dry for at least half of the year. Soils that have an aridic moisture regime typically occur in arid climates.

A few are in semiarid climates and either have physical properties that keep them dry, such as a crusty surface that virtually precludes the infiltration of water, or are on steep slopes where runoff rates are high. There is little or no leaching in this moisture regime, and the soluble salts accumulate in the soils if there is a source.

Arroyo. The channel of a flat-floored ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material; it is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed. Where arroyos intersect zones of ground-water discharge, they are more properly classed as intermittent stream channels. Sometimes called a wash.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity) (AWC). The volume of water that should be available to plants if the soil, inclusive of fragments, were at field capacity. It is commonly estimated as the amount of water held between field capacity and wilting point, with corrections for salinity, fragments, and rooting depth. It is commonly expressed as inches of water per inch of soil. In California, the capacity in a 60-inch profile or to a limiting layer is expressed in inches as:

Very low	0 to 2.5
Low	2.5 to 5
Moderate	5 to 7.5
High	7.5 to 10
Very high	more than 10

AWC. See Available water capacity.

Backslope. The hillslope profile position that forms the steepest and generally linear, middle portion of the slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below. They may or may not include cliff segments (i.e., free faces). Backslopes are commonly erosional forms produced by mass movement, colluvial action, and running water.

Badland. A landscape which is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes with narrow interfluves. Badlands develop on surfaces with little or no vegetative cover, overlying unconsolidated or poorly cemented materials (clays, silts, or in some cases sand) that may have soluble minerals such as gypsum or halite.

Bajada. A broad, gently inclined piedmont slope extending from the base of a mountain range into a basin. It is formed by the lateral coalescence of a series of alluvial fans. Typically it has a broadly undulating transverse profile that is parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Bar (coast). A generic term for any of various elongate offshore ridges, banks, or mounds of sand, gravel, or other unconsolidated material submerged at least at high tide and built up by the action of waves or currents, especially at the mouth of a river or estuary, or at a slight distance from the beach.

Bar (microfeature). A small, sinuous or arcuate ridge-like lineation separated from others like it by small channels; caused by fluvial processes and common to flood plains and young alluvial terraces; a constituent part of bar and channel topography.

Bar (stream). A general term for a ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition; e.g., a channel or meander bar.

Bar and channel. A local-scale topography of recurring, small, sinuous or arcuate ridges separated by shallow troughs irregularly spaced across low-relief flood plains (slopes of generally 2 to 6 percent); the effect is a subdued, sinuously

undulating surface that is common on active flood plains. Micro-elevational differences generally range from less than 1 to less than 2 meters. The elevational differences between bars and channels are largely controlled by the competency of the stream. The ridge-like bars often consist of coarser sediments compared to the finer textured sediments of the low areas.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Basin. A nearly level or gently sloping bottom surface of a wide structural depression between mountain ranges.

Basin floor. A general term for the nearly level, lowermost part of intermontane basins (i.e., bolsons and semi-bolsons). The floor includes all of the alluvial, eolian, and erosional landforms below the piedmont slope.

Batholith. A large body of igneous intrusive (plutonic) rock, often regional in extent, such as the Sierra Nevada batholith.

Bay mud. Quaternary deposits of soft, unconsolidated silty clay which is saturated with water. These soil layers are situated at the bottom of estuaries. Bay mud has low shear strength, high compressibility, low permeability, and typically an accumulation of heavy metals. It is also potential acid sulphate soil material; when protected from flooding and exposed to air, acid sulphate soils develop. Bay mud is separated from mudflats by continuous flooding.

Beach terrace. (a) A landform that consists of a wave-cut scarp and wave-built terrace of well sorted sand and gravel of marine and lacustrine origin; (b) (colloquial term of western United States) relict shorelines from pluvial lakes, generally restricted to valley sides.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. A general term for the solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bolson. A landscape term for an internally drained (closed) intermontane basin into which drains from surrounding mountains converge inward toward a central depression.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Manipulating woody plant cover to obtain desired quantities and types of woody cover and/or to reduce competition with herbaceous understory vegetation in accordance with overall resource management objectives.

Bulk density. A measurement of the oven-dried weight of the less than 2-millimeter soil material per unit volume of soil. Common measurements are taken at a water tension of $^1/_{10}$-bar, $^1/_3$-bar, or 15-bar. Bulk density influences plant growth and engineering applications. It is used to convert measurements from a weight basis to a volume basis. Within a family particle-size class, bulk density is an indicator of how well plant roots are able to extend into the soil. Bulk density is used to calculate porosity.

Butte. An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs; characterized by a summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material, and representing an erosion remnant carved from flat-lying rocks.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Calcic horizon. A mineral soil horizon of secondary carbonate enrichment that is greater than 15 centimeters thick, has a $CaCO_3$ equivalent of greater than 150g kg^{-1}, and has at least 50g kg^{-1} more calcium carbonate equivalent than the underlying C horizon.

Calcium carbonate equivalent. The quantity of carbonate (CO_3) in the soil expressed as $CaCO_3$ and as a weight percentage of the less than 2-millimeter size fraction.

Caliche. A general term for a prominent zone of secondary carbonate accumulation in surficial materials of warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in non-indurated forms to very strong in types that are indurated. Other minerals (carbonates, silicate, and sulfate) may be present as accessory cements. Most petrocalcic and some calcic horizons are caliche.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Cambic horizon. A mineral soil horizon that has a texture of loamy very fine sand or finer material, has a soil structure rather than rock structure, contains some weatherable minerals, and is characterized by the alteration or removal of mineral material as indicated by mottling or gray colors, stronger chromas or redder hues than in the underlying horizons, or the removal of carbonates. The cambic horizon lacks cementation or induration and has too few evidences of illuviation to meet the requirements of the argillic horizon.

Canopy cover. The percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included. Synonym: Crown cover.

Canyon. A long, deep, narrow, very steep-sided valley with high and precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence of soils across a landscape, of about the same age, derived from similar parent material, and occurring under similar climatic conditions, but having different characteristics due to variations in relief and in drainage.

Cathodic protection. The control of the electrolytic corrosion of an underground or underwater metallic structure (such as a pipeline) by the application of an electric current in such a way that the structure is made to act as the cathode instead of anode of an electrolytic cell. See Coatings for pipelines.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity (CEC). The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil. Not the preferred term; see Terracette.

CEC. See Cation-exchange capacity.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cinders. Uncemented vitric, vesicular, pyroclastic material more than 2.0 millimeters in at least one dimension, with an apparent specific gravity (including vesicles) of more than 1.0 and less than 2.0.

Cirque. A semicircular, concave, bowl-like area with steep faces primarily resulting from the erosive activity of a mountain glacier.

Clay. As a soil separate, the minerals soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clayey. Texture group consisting of sandy clay, silty clay, and clay textures.

Claypan. A dense, compact, slowly permeable layer in the subsoil with a much higher clay content than overlying materials from which it is separated by a sharply defined boundary. A claypan is usually hard when dry and plastic or sticky when wet.

Climax plant community. See Historic climax plant community.

Coarse fragments. See Rock fragments.

Coarse textured soil. Sand or loamy sand.

Coatings for pipelines. Coatings that provide a barrier to the flow of electricity and moisture, thereby preventing the formation of corrosion cells.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (Coefficient of linear extensibility). See Linear extensibility.

Colluvium. Unconsolidated, unsorted earth material transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Compaction. The process by which soil grains are rearranged to decrease void space and bring them into closer contact with one another, thereby increasing the bulk density.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to separate them at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Congeliturbate. Not the recommended term; see Cryoturbation.

Conglomerate. A coarse grained, clastic sedimentary rock composed of rounded to subangular rock fragments larger than 2 millimeters, commonly with a matrix of sand and finer material; cements include silica, calcium carbonate, and iron oxides. The consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coppice dune. A small dune of fine grained soil material stabilized around shrubs or small trees.

Coprogenous earth (Soil Taxonomy). A type of limnic layer (sedimentary peat) composed predominantly of fecal material derived from aquatic animals.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbation. A collective term used to describe all soil movements due to frost action; characterized by folded, broken, and dislocated beds and lenses of unconsolidated deposits.

Cuesta. An asymmetric, homoclinal ridge capped by resistant rock layers of slight to moderate dip (less than 10 degrees or 16 percent); produced by differential erosion of interbedded resistant and weak rocks. A long, gently sloping to sloping face (dip slope) roughly paralleling the inclined beds; opposes a relatively short and steep (scarp) face cut across the tilted rocks.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Debris flow (mass movement). A process, its associated sediments (debris flow deposit), or the resultant landform characterized by a very rapid type of flow dominated by a sudden, downslope movement of a mass of rock, soil, and mud (more than 50 percent particles are larger than 2 millimeters), and, whether saturated or comparatively dry, behaves much as a viscous fluid.

Deep soil. See Depth, soil.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period to meet a specific management objective.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to bedrock (in tables). Bedrock is too near the surface for the specified use.

Desert pavement. A natural, residual concentration of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface where wind action and sheetwash have removed all smaller particles. It usually protects the underlying, finer grained material from further deflation. The coarse fragments commonly are cemented by mineral matter.

Dip slope. A slope of land surface, roughly determined by and approximately conforming to the dip of underlying bedded rocks; for example, the long, gently inclined surface of a cuesta.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. A general term for a course or channel along which water moves in draining an area.

Draw. A small stream channel, generally more open and with a broader floor than a ravine or gulch.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune. A low mound, ridge, bank, or hill of loose, windblown, granular material (generally sand), either bare or covered with vegetation, capable of movement from place to place but always retaining its characteristic shape.

Duripan. A subsurface soil horizon that is cemented by illuvial silica, typically opal or microcrystalline forms of silica, to the degree that less than 50 percent of the volume of air-dry fragments will slake in water or HCl.

EC. See Electrical conductivity.

Ecological site. A distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. Refer to the NRCS "National Range and Pasture Handbook" for descriptions and further information.

Electrical conductivity (EC). The electrolytic conductivity of an extract from saturated soil paste.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian. Pertaining to material transported and deposited by the wind. Includes earth materials such as dune sands, sand sheets, loess deposits, and clay.

Ephemeral stream. Generally a small stream, or upper reach of a stream, that flows only in direct response to precipitation. It receives no protracted supply from melting snow or other source, and its channel is, at all times, above the water table.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by running water, waves, or moving ice and wind, or by such processes as mass wasting and corrosion (solution and other chemical processes). The term “geologic erosion” refers to natural erosion processes occurring over long (geologic) time spans. “Accelerated erosion” generally refers to erosion in excess of what is presumed or estimated to be naturally occurring levels, and which is a direct result of human activities.

Erosional pavement. A concentration of gravel or coarser fragments that remains on the soil surface as a lag after finer particles have been removed by running water or wind.

Escarpment. A relatively continuous cliff or relatively steep slope, produced by erosion or faulting, breaking the general continuity of more gently sloping land surfaces. The term is most commonly applied to cliffs produced by differential erosion, and it is commonly used synonymously with “scarp.”

Extrusive. Indicates igneous rocks and sediments derived from deep-seated molten matter (magma) deposited and cooled on the earth’s surface (including lava flows and tephra deposits).

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Family, soil. The most specific hierarchical category in Soil Taxonomy. Refer to the section “Classification of the Soils.”

Fan piedmont. The most extensive landform on piedmont slopes, formed by: (a) the lateral, downslope, coalescence of mountain-front alluvial fans into one generally smooth slope with or without the transverse undulations of the semi-conical alluvial fans; and (b) accretions of fan aprons.

Fan remnant. A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan remnants) or partially buried (nonburied fan remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan surface. A nonburied fan remnant is a relict surface in its entirety.

Fan terrace. Refer to Fan remnant.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is typically a constructional landform built of sediment deposited during overflow and lateral migration of the streams.

Fluvial. Pertaining to rivers; produced by river action.

Foothills. A steeply sloping upland with hill relief (up to 300 meters) that fringes a mountain range or high-plateau escarpment.

Footslope. The hillslope position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. It is a transition zone between upslope sites of erosion and transport (i.e., shoulder and backslope) and downslope sites of deposition (i.e., toeslope).

Forb. Any broad-leafed herbaceous plant other than those in the Gramineae (or Poaceae), Cyperaceae, and Juncaceae families.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Forestland. Land on which the historic climax plant community is dominated by trees.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Fragments. Unattached cemented pieces of bedrock, bedrock-like material, durinodes, concretions, and nodules 2 millimeters or larger in diameter and woody material 20 millimeters or larger in organic soils.

Fumarole. A hole in a volcanic region from which gases and vapors issue at high temperature.

Fumarolic. Of or pertaining to fumaroles or vents near volcanoes from which volcanic gasses escape.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. The microrelief of soils produced by expansion and contraction with changes in moisture. Found in soils containing large amounts of smectitic clay that swell and shrink considerably with wetting and drying. Typically a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel to the direction of the slope. Also referred to, in part or in total, as crabhole, Bay of Biscay, or hushabye in older literature.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Granite. A felsic igneous intrusive rock containing quartz and orthoclase, with smaller amounts of sodic plagioclase and often muscovite.

Granitic. A rock textural term usually pertaining to an igneous intrusive rock of felsic to intermediate composition. Granite-like, but not necessarily true granite. Commonly applied to granite, quartz monzonite, granodiorite, and diorite.

Granodiorite. An igneous intrusive rock intermediate between felsic and mafic in composition and containing quartz and more plagioclase than orthoclase.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A small channel with steep sides caused by erosion and cut by concentrated but intermittent flow of water usually during and immediately following heavy rains or after ice or snow melt. A gully generally is an obstacle to wheeled vehicles and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. The percent, by weight, of hydrated calcium sulfates in the less than 20-millimeter fraction of soil.

Halophytic. Term for vegetation that is adapted to salty soils.

Hard bedrock. Bedrock that cannot be excavated, except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A generic term for an area of the land surface, rising as much as 300 meters above surrounding lowlands, typically of restricted summit area relative to surrounding surfaces and having a well defined outline; hillslopes generally exceed 15 percent. The distinction between a hill and a mountain is often dependent on local usage.

Historic climax plant community. The plant community on an ecological site in North America that existed before European immigration and settlement. It is the plant community that had developed on the site as a result of all the site-forming factors. This term differs from “potential natural vegetation.”

Hogwallow. See Mound-intermound microrelief.

Holocene. The epoch of the Quaternary Period of geologic time, extending from the end of the Pleistocene Epoch (about 10 to 12 thousand years ago) to the present.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.
Cr horizon.—Soft, consolidated bedrock beneath the soil.
R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hummock. A rounded or conical mound.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic group. See Hydrologic soil groups.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state; major varieties include plutonic and volcanic rocks. Examples: andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Inset fan. A special name for the flood plain of an ephemeral stream that is confined between the fan remnants, ballenas, basin-floor remnants, or closely opposed fan toeslopes of a basin.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that does not flow year-round (commonly dry for 3 or more months out of 12) and whose channel is generally below the local water table; it flows only when: (a) it receives baseflow solely during wet periods; or (b) it receives ground-water discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources.

Intrusive. Denotes igneous rocks derived from molten matter (magma) that invaded pre-existing rocks and cooled below the surface of the earth.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Level basin (paddy).—Water is applied to a level plain surrounded by levees or dikes.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

K factor. A measurement of potential soil erodibility caused by detachment of soil particles by water.

Kame. A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier, by a supraglacial stream in a low place or hole on the surface of the glacier, or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst. A kind of topography formed in limestone, gypsum, or other soluble rocks by dissolution and characterized by sinkholes, caves, and underground drainage.

K_{sat}. Saturated hydraulic conductivity. (See Permeability.)

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Clastic sediments and chemical precipitates deposited in lakes.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Leaching. The removal of soluble material from soil or other material by percolating water.

LEP. See Linear extensibility percent.

Levee. An embankment alongside a river, produced naturally by sedimentation as a natural levee or constructed by man to prevent flooding. Levees are also constructed in estuaries and marshes to prevent tidal flooding.

Level basin (paddy). Water is applied to a level plain surrounded by levees or dikes.

Limestone. A sedimentary rock consisting chiefly (more than 50 percent) of calcium carbonate primarily in the form of calcite. Limestone is usually formed by a combination of organic and inorganic processes and includes chemical and clastic (soluble and insoluble) constituents; many contain fossils.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Linear extensibility percent (LEP). The linear expression of the volume difference of natural soil fabric at $^1/_3$ bar or $^1/_{10}$ bar water content and oven dryness. The volume change is reported as percent change for the whole soil.

Liquid limit (LL). The moisture content at which the soil passes from a plastic to a liquid state.

LL. See Liquid limit.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy. The texture group consisting of coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, and silty clay loam soil textures.

Loess. Material transported and deposited by wind and consisting predominantly of silt-sized clastics.

Low strength. The soil is not strong enough to support loads.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Magma. Molten rock material that originates deep in the earth and solidifies to form igneous rocks.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions (35 to 65 percent of each); formed primarily under freshwater lacustrine conditions, but varieties associated with more saline environments also occur.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat-topped, and typically isolated landmass bounded by steep slopes or precipitous cliffs, characterized by summit widths that are greater than the heights of bounding escarpments. (Colloquial in western United States; not preferred term.) Also used to designate broad structural benches and alluvial terraces that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline. Examples: schist, gneiss, quartzite, slate, and marble.

Metasediment. A sediment or sedimentary rock that shows evidence of having been subjected to metamorphism.

Metavolcanic. A volcanic rock that shows evidence of metamorphism, but that has not been fully changed into metamorphic rock.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential for crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. See Depth, soil.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine (glacial geology). (a) As material, a mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited primarily by the direct action of glacier ice, in a variety of topographic landforms; (b) as a landform, a general term for a landform composed mainly of till deposited by either an active or extinct glacier. Types of moraines include disintegration, end, lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many; size*—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mound-intermound microrelief. Circular or oval domes, generally 1 to 3 feet in height and 115 to 100 feet in diameter with intervening basin-shaped depressions, which commonly have no external drainage. In various parts of the West, this particular kind of microrelief is called by many names; the terms "hogwallow" and "mima mounds" are commonly used.

Mountain. A natural elevation of the land surface, rising more than 300 meters above surrounding lowlands, typically of restricted summit area relative to surrounding surfaces and generally having steep sides (greater than 25 percent slope) with or without considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by tectonic activity and/or volcanic action and secondarily by differential erosion.

Muck. Unconsolidated soil material consisting primarily of highly decomposed organic material in which the original plant parts are not recognizable (i.e., sapric material in Soil Taxonomy). It generally contains more mineral matter and is typcially darker in color than peat.

Mud flats. Areas of bay mud that are exposed at low tide and flooded at high tide. Mud flats remain saturated with a high water table even at low tide, preventing oxidation to acid sulfate soils. Mud flats occur at the edge of saline estuaries, marshes, and swamps. They provide valuable areas of wildlife habitat.

Mudstone. (a) A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal; (b) a general term that includes clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. A geomorphic component of hills consisting of the projecting, and laterally convex, area of a hillside. The overland waterflow is predominantly divergent.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

OM. See Organic matter.

Organic matter (OM). Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive lowland area of coarse textured, glaciofluvial material. An outwash plain is commonly smooth; where pitted, due to melt-out of incorporated ice masses, it is generally low in relief.

Paleosol. A soil that formed on a landscape in the past with distinctive morphological features resulting from a soil-forming environment that no longer exists at the site. The former pedogenic process was either altered because of external environmental change or interrupted by burial. A paleosol (or component horizon) may be classed as relict if it has persisted in a land-surface position without major alteration of morphology by processes of the prevailing pedogenic environment. An exhumed paleosol is one that formerly was buried and has been re-exposed by erosion of the covering mantle. Most paleosols have been affected by some subsequent modification of diagnostic horizon morphologies and profile truncation.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Parent material. The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum is developed by pedogenic processes.

Peat. Unconsolidated soil material consisting largely of undecomposed, or slightly decomposed, organic matter (i.e., fibric material in Soil Taxonomy) accumulated under conditions of excessive moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping erosional surface developed at the foot of a receding hill or mountain slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands, or it may be thinly mantled with alluvium and colluvium, ultimately in transit from upland front to basin or valley lowland. In hill-footslope terrain, the mantle is designated "pedisediment." The term has been used in several geomorphic contexts. Pediments may be classed with respect to: (a) landscape positions, for example, intermontane-basin piedmont or valley-border footslope surfaces (apron and terrace pediments, respectively); (b) type of material eroded, bedrock or regolith; or (c) combinations of the above.

Pedisediment. A layer of sediment eroded from the shoulder and backslope of an erosional slope that lies on and is, or was, being transported across a pediment.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Perched water table. The upper surface of unconfined ground water separated from and underlying the main body of ground water by an unsaturated zone.

Percolation. The downward movement of water through the soil.

Permafrost. Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

PI. See Plasticity index.

Piedmont. (a) As an adjective, lying or formed at the base of a mountain or mountain range, e.g., a piedmont terrace or a piedmont pediment; (b) as a noun, an area, plain, slope, glacier, or other feature at the base of a mountain, e.g., foothill or bajada. In the United States, the Piedmont is a low plateau extending from New Jersey to Alabama and lying east of the Appalachian Mountains.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index (PI). The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology). A comparatively flat area of great extent and elevation; specifically an extensive land region considerably elevated (more than 100 meters)

above adjacent lower-lying terrain. It is commonly limited on at least one side by an abrupt descent and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa. The typically dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those occurring on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation-runoff events. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Pleistocene. The epoch the Quaternary Period of geologic time, following the Pliocene Epoch and preceding the Holocene (from approximately 2 million to 10 thousand years ago); also the corresponding (time-stratigraphic) “series” of earth materials.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, typically in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential acid sulfate soils. These soils have the potential to develop into acid sulfate soils if drained and oxidized. (See Acid sulfate soils.) They are also known as bay mud or mud flats and are not acid in the undrained state.

Potential natural vegetation (PNV). Also called potential natural community (PNC). The biotic community that would become established on an ecological site if all successional sequences were completed without interferences by humans under the present environmental conditions. Natural disturbances are inherent in its development. It may include acclimatized or naturalized non-native species. This differs from “historic climax plant community.”

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The use of fire as a tool to achieve a management objective in a predetermined area under conditions where the intensity and extent of the fire are controlled.

Prescribed grazing. The controlled harvest of vegetation with grazing or browsing animals, managed to achieve a specific objective.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. See Prescribed grazing.

Pyroclastic. Pertaining to fragmental materials produced by the usually explosive, aerial ejection of clastic particles from a volcanic vent. Such materials may accumulate on land or under water.

Range site. See Ecological site.

Rangeland. Land on which the historic climax plant community is predominantly grasses, grasslike plants, forbs, or shrubs. It includes land revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Rangelands include natural grasslands,

savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma *in situ* because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits. Soil scientists regard as soil only that part of the regolith that is modified by organisms and soil-forming processes. Most engineers describe the whole regolith, even to a great depth, as “soil.”

Relief. The elevations or inequalities of a land surface, considered collectively.

Remnant. A remaining part of some larger landform or of a land surface that has been dissected or partially buried.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rhyolite. A group of extrusive igneous rocks, generally porphyritic and exhibiting flow texture, with phenocrysts of quartz and alkali feldspar in a glassy cryptocrystalline groundmass; also, any rock in that group; the extrusive equivalent of granite.

Rill. A small channel with steep sides caused by erosion and cut by concentrated but intermittent flow of water, usually during and immediately following moderate rains or after ice/snow melt. Generally, a rill is not an obstacle to wheeled vehicles and is shallow enough to be obliterated by ordinary tillage.

Riverwash. Barren alluvial areas of unstabilized sand, silt, clay, or gravel reworked frequently by stream activity.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, gravel, cobbles, stones, and boulders.

Rock outcrop. Exposures of bedrock other than lava and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium. Salinity is expressed as the electrical conductivity of a saturation extract in millimhos per centimeter at 25 degrees C. Salinity classes are:

Nonsaline	0 to 2
Very slightly saline	2 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Saline sodic soil. A soil containing sufficient exchangeable sodium to interfere with the growth of most crop plants and containing appreciable quantities of soluble salts. The exchangeable sodium ratio is greater than 0.15; the conductivity of the soil solution, at saturated water content, is greater than 4 dS/m (at 25 degrees C); and the pH is typically 8.5 or less in the saturated soil.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy. Texture group consisting of sand and loamy sand textures.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Soft, friable, isovolumetrically weathered bedrock that retains the fabric and structure of the parent rock and exhibits extensive inter-crystal and intra-crystal weathering. In pedology, saprolite was formerly applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.

SAR. See Sodium adsorption ratio.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under “normal” low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, and drift and eolian, lacustrine, marine deposits; e.g., sandstone, siltstone, mudstone, clay-stone, shale, conglomerate, limestone, dolomite, and coal.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by induration of a clay, silty clay, or silty clay loam deposit and having the tendency to split into thin layers, i.e., fissility.

Shallow soil. See Depth, soil.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A closed depression formed either by solution of the surficial bedrock (e.g., limestone, gypsum, and salt) or by collapse of underlying caves. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Site index (pinyon and juniper species). The designation of the stand based upon the basal area in square feet when the stand averages 5 inches in diameter at breast height. For example, a site index of 50 means that when the average stand diameter is 5 inches the stand will have a basal area of 50 square feet.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope aspect. The direction which the surface of the soil faces.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil erodibility factors. Factors Kw and Kf are erodibility factors which quantify the susceptibility of soil detachment by water. These erodibility factors predict the long-term average soil loss resulting from sheet and rill erosion under various alternative combinations of crop systems and conservation techniques. Factor Kw considers the whole soil, and factor Kf considers only the fine-earth fraction, which is the material less than 2.0 millimeters in diameter. The procedure for determining the Kf factor is outlined in Agriculture Handbook No. 537 "Predicting Rainfall-Erosion Losses, A Guide to Conservation Planning." The K factors in Hawaii and the Pacific Basin were extrapolated from local research. The nomograph was not used.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A sheet-like lag concentration of coarse fragments in surficial sediments. In cross section, the line may be marked only by scattered fragments or it may be a discrete layer of fragments. The fragments are more often pebbles or cobbles than stones. A stone line generally overlies material that was subject to weathering, soil formation, and erosion before deposition of the overlying material. Many stone lines seem to be buried erosion pavements, originally formed by running water on the land surface and concurrently covered by surficial sediment.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Formed, arranged, or laid down in layers. The term refers to geologic deposits. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stream terrace. One of a series of platforms in a stream valley; flanking and more or less parallel to the stream channel, originally formed near the level of the stream,

and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy (laminated), prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsidence. The decrease in surface elevation as a result of the drainage of wet soils that have organic layers or semifluid, mineral layers.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

T factor. The soil loss tolerance. It is defined as the maximum amount of erosion at which the quality of a soil as a medium for plant growth can be maintained. This quality of the soil to be maintained is threefold in focus. It includes maintaining: (1) the surface soil as a seedbed for plants; (2) the atmosphere-soil interface to allow the entry of air and water into the soil and still protect the underlying soil from wind and water erosion; and (3) the total soil volume as a reservoir for water and plant nutrients, which is preserved by minimizing soil loss.

Talus. Rock fragments of any size or shape (typically coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Temperature regime, soil. A system that categorizes, for taxonomic purposes, the general, long-term soil temperature conditions at the standard depth of 20 inches or at the bedrock surface, whichever is shallower. The various regimes are defined according to the freezing point of water, or to the high and low extremes for

significant biological activity. The regimes, which are fully defined in "Keys to Soil Taxonomy," are outlined as follows:

Pergellic.—Soils that have a mean annual temperature less than 32 degrees F and that have permafrost.

Cryic.—Soils that have a mean annual temperature between 32 degrees F and 47 degrees F and remain cold in summer.

Frigid.—Soils that have mean annual temperatures similar to those in the cryic regime, but whose average summer temperature is at least 9 degrees F warmer.

Mesic.—Soils that have mean annual temperatures between 47 and 59 degrees F, and the difference between summer and winter temperatures is greater than 9 degrees F.

Thermic.—Soils that have mean annual temperatures between 59 degrees F and 72 degrees F, and the difference between mean summer and winter temperatures is greater than 9 degrees F.

Hyperthermic.—Soils that have a mean annual temperature greater than 72 degrees F, and the difference between mean summer and mean winter temperatures is greater than 9 degrees F.

Terminal moraine. An end moraine that marks the farthest advance of a glacier and typically has the form of a massive arcuate or concentric ridge, or complex of ridges, underlain by till and other drift types.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Terrace (geomorphology). A step-like surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or sea shore. The term is usually applied to both the relatively flat summit surface (tread) cut or built by stream or wave action and the steeper descending slope (scarp or riser) graded to a lower base level of erosion.

Terrace (soil survey). Practically, terraces are considered to be generally flat alluvial areas above the 100-year flood stage.

Terracette. A small, irregular step-like form on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may or may not be induced by trampling of livestock, such as sheep or cattle.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thermic temperature regime. See Temperature regime.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Torric moisture regime. See Aridic moisture regime.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tuff. A generic term for any consolidated or cemented deposit that is 50 percent volcanic ash (less than 2 millimeters). Various types of tuff can be recognized based on composition: acidic tuff is predominantly composed of acidic particles and basic tuff is predominantly composed of basic particles.

Unified soil classification. A system for classifying mineral and organic mineral soils for engineering purposes based on particle-size characteristics, liquid limit, and plasticity index.

Upland (geomorphology). An informal, general term for: (a) the higher ground of a region, in contrast with a low-lying, adjacent land such as a valley or plain; (b) land at a higher elevation than the flood plain or low stream terrace; and (c) land above the footslope zone of the hillslope continuum.

Valley fill. The unconsolidated sediment deposited by any agent (such as water, wind, ice, and mass wasting) that fills or partly fills a valley.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer, lamina, or sequence of laminae deposited in a body of still water within 1 year; specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Vegetative cover. The crown cover of all live plants in relation to the ground surface.

Vernal pool. Shallow surficial depressions that temporarily fill with water during winter and spring rains and desiccate during the dry summer months. They occur as small poorly drained depressions perched above an impermeable or very slowly permeable soil horizon or bedrock.

Very deep soil. See Depth, soil.

Very shallow soil. See Depth, soil.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water table. The upper surface of ground water or that level below which the soil is saturated by water. Also the top of an aquifer.

WEG. See Wind erodibility group.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Wind erodibility group (WEG). A grouping of soils that have similar properties affecting their resistance to soil blowing in cultivated areas.

Windthrow. The uprooting and tipping over of trees by the wind.

Xeric moisture regime. The typical moisture regime in areas of Mediterranean climates, where winters are moist and cool and summers are warm and dry. The moisture, which falls during the winter, when potential evapotranspiration is at a minimum, is particularly effective at leaching. The mean annual soil temperature is lower than 22 degrees C, and the mean summer and mean winter soil temperatures differ by 6 degrees C.

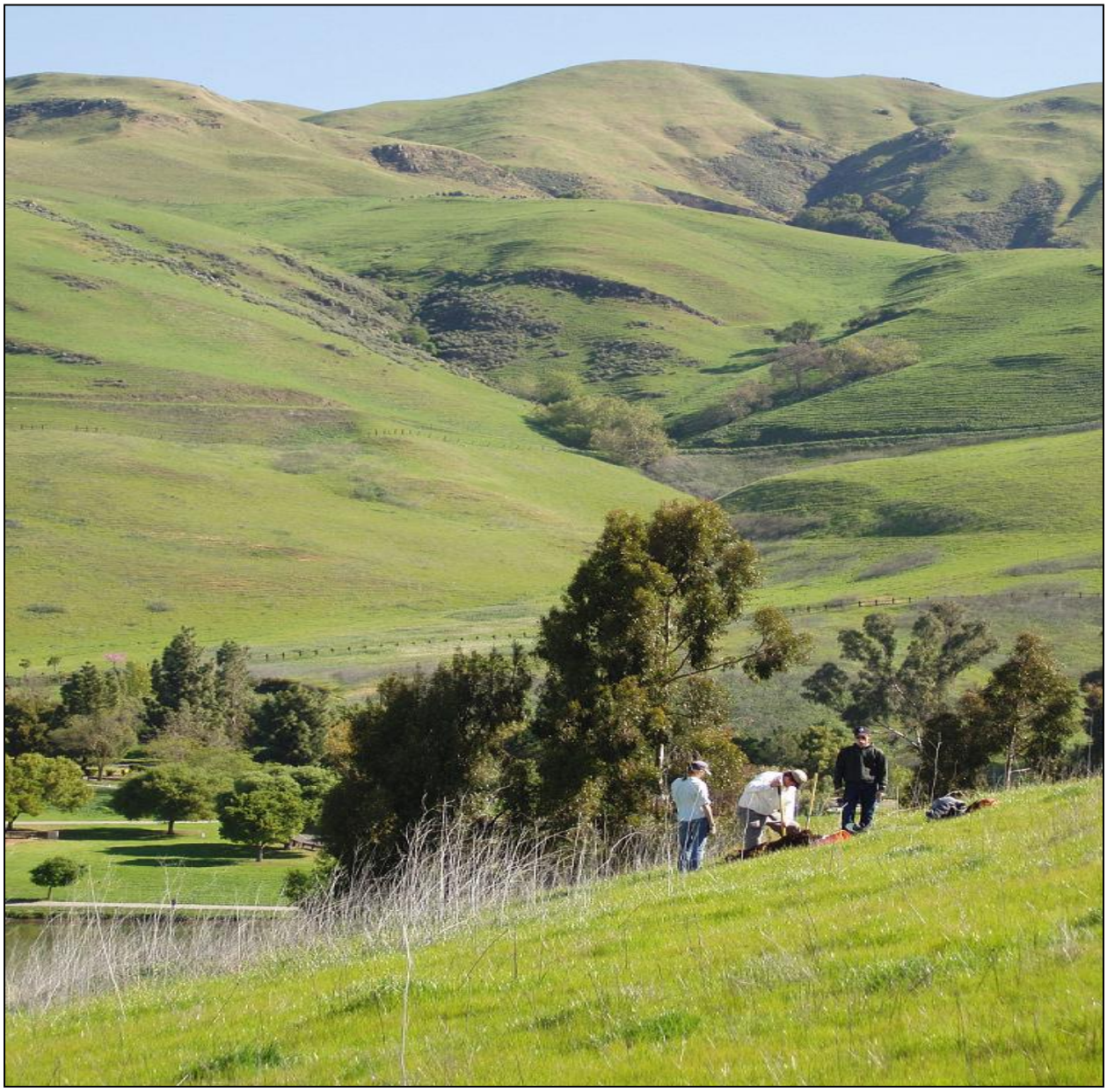
Xerophytic. Term for vegetation that is adapted to dry places.

Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The USDA Target Center can convert USDA information and documents into alternative formats, including Braille, large print, video description, diskette, and audiotape. For more information, visit the TARGET Center's Web site (http://www.targetcenter.dm.usda.gov/) or call (202) 720-2600 (Voice/TTY).

UNITED STATES DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service
Classification and Correlation
of the Soil Survey of
Santa Clara Area, California, Western Part
CA641



UNITED STATES DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

Classification and Correlation

of the Soil Survey of

Santa Clara Area, California, Western Part

CA641

2. Introductory Paragraph.

The final correlation conference was held in August of 2009 by Bill Reed, Project Leader, and Kit Paris, Soil Data Quality Specialist. The Final Correlation for the Santa Clara Western Part was conducted over a 3-month period in the Davis, CA MLRA Regional Office and was further modified during ongoing Technical Review. The soil survey database, soil survey publication, field notes, interpretations, laboratory data, correlation samples, field map sheets, and materials from the adjacent and internal interim soil surveys provide the basis for this correlation. The mapping began April 2004 and has been under the direction of Bill Reed for the duration of the survey. Soil scientists who contributed mapping and expertise include Lorena Benitez, Valerie Bullard, Bruce Lindsay, and Bill Reed.

3. Headnote for Detailed Soil Survey Legend.

This headnote is an explanation of the symbols on the detailed soil maps in the published survey. It appears on the "SOIL LEGEND" in the published report and precedes the list of map unit symbols and map unit names. Map unit symbols consist of three digit numbers starting at 101. The legend was created correlating and updating old map unit symbols from scattered mapping and interim legends. The numbers are not contiguous and gaps may occur. The numbers carry no special connotative value.

This survey is classified as an initial soil survey mapping in the modern sense but it is really an update or remap of a prior unpublished or uncorrelated report completed in 1968. The original survey had no digitized mapping (recompiled), no database, and no correlation document. Although many mapping concepts and series names were used from the old survey, this new soil survey is considered a new and modern product. Many new series were set up and new mapping was digitized. A large amount of land use change has occurred since the old survey was finished and this along with modern mapping techniques has vastly improved the information.

4. Field and Publication Names and Symbols.

Soil Correlation Of
Santa Clara Area, California, Western Part: Detailed Soil Map Legend

Field symbols	Field map unit name	Publi-cation symbol	Approved map unit name
100	Urban land, 0 to 2 percent slopes, basins	101	Urban land, 0 to 2 percent slopes, basins
102	Urban land, 0 to 2 percent slopes, alluvial fans	102	Urban land, 0 to 2 percent slopes, alluvial fans
110	Xerorthents, trash substratum, 0 to 2 percent slopes	110	Xerorthents, trash substratum, 0 to 2 percent slopes
110sc	Ben Lomond sandy loam, 5 to 15 percent slopes	110sc	Ben Lomond sandy loam, 5 to 15 percent slopes
111	Xerorthents, trash substratum, 9 to 15 percent slopes	111	Xerorthents, trash substratum, 9 to 15 percent slopes
112	Xerorthents, trash substratum 15 to 30 percent slopes	112	Xerorthents, trash substratum 15 to 30 percent slopes
113	Xerorthents, trash substratum, 30 to 50 percent slopes	113	Xerorthents, trash substratum, 30 to 50 percent slopes
115	Pits, mine	115	Pits, mine
116sc	Bonnydoon loam, 5 to 30 percent slopes	116sc	Bonnydoon loam, 5 to 30 percent slopes
120	Aquic Xerorthents, bay mud subtratum, 0 to 2 percent slopes	120	Aquic Xerorthents, bay mud subtratum, 0 to 2 percent slopes
121	Aquic Xerorthents, bay mud substratum, 2 to 5 percent slopes	121	Aquic Xerorthents, bay mud substratum, 2 to 5 percent slopes
122	Xerorthents, anthropogenic fill, 0 to 2 percent slopes	122	Xerorthents, anthropogenic fill, 0 to 2 percent slopes
123	Urban Land-Xerorthents, anthropogenic fill complex, 0 to 2 percent slopes	123	Urban Land-Xerorthents, anthropogenic fill complex, 0 to 2 percent slopes
129	Urban land-Still complex, 2 to 5 percent slopes	129	Urban land-Still complex, 2 to 5 percent slopes
130	Urban land-Still complex, 0 to 2 percent slopes	130	Urban land-Still complex, 0 to 2 percent slopes
131	Urban land-Elpaloalto complex, 0 to 2 percent slopes	131	Urban land-Elpaloalto complex, 0 to 2 percent slopes
135	Urban land-Stevenscreek complex, 0 to 2 percent slopes	135	Urban land-Stevenscreek complex, 0 to 2 percent slopes
136	Urban land-Stevenscreek complex, 2 to 9 percent slopes	136	Urban land-Stevenscreek complex, 2 to 9 percent slopes
137	Stevenscreek sandy clay loam, 0 to 2 percent slopes	137	Stevenscreek sandy clay loam, 0 to 2 percent slopes
140	Urban land-Flaskan complex, 0 to 2 percent slopes	140	Urban land-Flaskan complex, 0 to 2 percent slopes
141	Urban land-Flaskan complex, 2 to 9 percent slopes	141	Urban land-Flaskan complex, 2 to 9 percent slopes
142	Flaskan sandy loam, 15 to 30 percent slopes	142	Flaskan sandy loam, 15 to 30 percent slopes
142sc	Lompico-Felton complex, 5 to 30 percent slopes	142sc	Lompico-Felton complex, 5 to 30 percent slopes
143	Flaskan sandy clay loam, 5 to 9 percent slopes	143	Flaskan sandy clay loam, 5 to 9 percent slopes
143sc	Lompico-Felton complex, 30 to 50 percent slopes	143sc	Lompico-Felton complex, 30 to 50 percent slopes
144	Flaskan sandy clay loam, 0 to 2 percent slopes	144	Flaskan sandy clay loam, 0 to 2 percent slopes
145	Urbanland-Hangerone complex, 0 to 2 percent slopes, drained	145	Urban land-Hangerone complex, 0 to 2 percent slopes, drained
146	Hangerone clay loam, drained, 0 to 2 percent slopes	146	Hangerone clay loam, drained, 0 to 2 percent slopes
149sc	Madonna loam, 15 to 30 percent slopes	149sc	Madonna loam, 15 to 30 percent slopes

Field and Publication Names and Symbols -- continued.

Field symbols	Field map unit name	Publi-cation symbol	Approved map unit name
150	Urbanland-Embarcadero complex, 0 to 2 percent slopes, drained	150	Urban land-Embarcadero complex, 0 to 2 percent slopes, drained
150sc	Maymen stony loam, 15 to 30 percent slopes	150sc	Maymen stony loam, 15 to 30 percent slopes
151	Embarcadero silty clay loam, drained, 0 to 2 percent slopes	151	Embarcadero silty clay loam, drained, 0 to 2 percent slopes
151sc	Maymen stony loam, 30 to 75 percent slopes	151sc	Maymen stony loam, 30 to 75 percent slopes
155	Novato clay, 0 to 1 percent slopes, tidally flooded	155	Novato clay, 0 to 1 percent slopes, tidally flooded
156	Novato silty clay loam, excessive salinity, 0 to 1 percent slopes, protected	156	Novato silty clay loam, excessive salinity, 0 to 1 percent slopes, protected
157	Novato clay, 0 to 1 percent slopes, protected	157	Novato clay, 0 to 1 percent slopes, protected
160	Urbanland-Clear Lake complex, 0 to 2 percent slopes	160	Urban land-Clear Lake complex, 0 to 2 percent slopes
161	Clear Lake silty clay, 0 to 2 percent slopes, drained	161	Clear Lake silty clay, 0 to 2 percent slopes, drained
165	Urbanland-Campbell complex, 0 to 2 percent slopes, protected	165	Urban land-Campbell complex, 0 to 2 percent slopes, protected
166	Campbell silt loam, 0 to 2 percent slopes, protected	166	Campbell silt loam, 0 to 2 percent slopes, protected
168	Elder fine sandy loam, protected, 0 to 2 percent slopes	168	Elder fine sandy loam, protected, 0 to 2 percent slopes
169	Urbanland-Elder complex, 0 to 2 percent slopes, protected	169	Urban land-Elder complex, 0 to 2 percent slopes, protected
170	Urbanland-Landelspark complex, 0 to 2 percent slopes	170	Urban land-Landelspark complex, 0 to 2 percent slopes
172	Elder fine sandy loam, 0 to 2 percent slopes, rarely flooded	171	Elder fine sandy loam, 0 to 2 percent slopes, rarely flooded
173	Caninecreek-Elder complex, 0 to 2 percent slopes, rarely flooded	173	Caninecreek-Elder complex, 0 to 2 percent slopes, rarely flooded
174	Urban Land-Caninecreek-Elder complex, 0 to 2 percent slopes	174	Urban Land-Caninecreek-Elder complex, 0 to 2 percent slopes
175	Urbanland-Botella complex, 0 to 2 percent slopes	175	Urban land-Botella complex, 0 to 2 percent slopes
176	Urban land-Botella complex, 2 to 9 percent slopes	176	Urban land-Botella complex, 2 to 9 percent slopes
177	Urban land-Botella complex, 9 to 15 percent slopes	177	Urban land-Botella complex, 9 to 15 percent slopes
178	Caninecreek-Elder complex, 1 to 5 percent slopes, protected	178	Caninecreek-Elder complex, 1 to 5 percent slopes, protected
180	Urbanland-Newpark complex, 0 to 2 percent slopes	180	Urban land-Newpark complex, 0 to 2 percent slopes
181	Newpark silty clay loam, 0 to 2 percent slopes	181	Newpark silty clay loam, 0 to 2 percent slopes
185	Bayshore, drained, 0 to 2 percent slopes	185	Bayshore, drained, 0 to 2 percent slopes
190	Cumulic Haploxerolls, 1 to 5 percent slopes	190	Cumulic Haploxerolls, 1 to 5 percent slopes
300	Urbanland-Montara complex, 15 to 30 percent slopes	300	Urban land-Montara complex, 15 to 30 percent slopes
301	Montara sandy loam, 15 to 50 percent slopes	301	Montara sandy loam, 15 to 50 percent slopes
302	Montara-Rock outcrop complex, 30 to 50 percent slopes	302	Montara-Rock outcrop complex, 30 to 50 percent slopes
303	Montara-Santerhill complex, 15 to 30 percent slopes	303	Montara-Santerhill complex, 15 to 30 percent slopes
304	Montara-Santerhill complex, 30 to 50 percent slopes	304	Montara-Santerhill complex, 30 to 50 percent slopes
305	Alo-Altamont complex, 15 to 30 percent slopes	305	Alo-Altamont complex, 15 to 30 percent slopes

Field and Publication Names and Symbols -- continued.

Field symbols	Field map unit name	Publi-cation symbol	Approved map unit name
306	Alo-Altamont complex, 30 to 50 percent slopes	306	Alo-Altamont complex, 30 to 50 percent slopes
307	Kawenga-Alo complex, 20 to 40 percent slopes	307	Kawenga-Alo complex, 20 to 40 percent slopes
308	Urbanland-Santerhill-Montara complex, 9 to 15 percent slopes	308	Urban land-Santerhill-Montara complex, 9 to 15 percent slopes
309	Urbanland-Altamont-Alo complex, 9 to 15 percent slopes	309	Urban land-Altamont-Alo complex, 9 to 15 percent slopes
310	Diablo clay, 15 to 30 percent slopes	310	Diablo clay, 15 to 30 percent slopes
311	Diablo clay, 30 to 50 percent slopes	311	Diablo clay, 30 to 50 percent slopes
312	Diablo-Urbanland complex, 9 to 15 percent slopes	312	Diablo-Urban land complex, 9 to 15 percent slopes
313	Diablo-Urbanland complex, 15 to 30 percent slopes	313	Diablo-Urban land complex, 15 to 30 percent slopes
314	Urbanland-Altamont-Alo complex, 15 to 30 percent slopes	314	Urban land-Altamont-Alo complex, 15 to 30 percent slopes
315	Cropley clay, 0 to 2 percent slopes	315	Cropley clay, 0 to 2 percent slopes
316	Cropley clay, 2 to 9 percent slopes	316	Cropley clay, 2 to 9 percent slopes
317	Urbanland-Cropley complex, 0 to 2 percent slopes	317	Urban land-Cropley complex, 0 to 2 percent slopes
318	Urban land-Cropley complex, 2 to 9 percent slopes	318	Urban land-Cropley complex, 2 to 9 percent slopes
320	Literr-Merbeth complex, 15 to 30 percent slopes	320	Literr-Merbeth complex, 15 to 30 percent slopes
321	Merbeth-Literr complex, 30 to 65 percent slopes	321	Merbeth-Literr complex, 30 to 65 percent slopes
322	Literr-Urbanland-Merbeth complex, 15 to 30 percent slopes	322	Literr-Urban land-Merbeth complex, 15 to 30 percent slopes
323	Minlum-Airship-Literr complex, 40 to 65 percent slopes	323	Minlum-Airship-Literr complex, 40 to 65 percent slopes
324	Literr loam, 15 to 30 percent slopes	324	Literr loam, 15 to 30 percent slopes
325	Minlum gravelly fine sandy loam, 15 to 30 percent slopes	320	Literr-Merbeth complex, 15 to 30 percent slopes
326	Airship-Minlum complex, 40 to 65 percent slopes	326	Airship-Minlum complex, 40 to 65 percent slopes
327	Literr-Urbanland-Merbeth complex, 9 to 15 percent slopes	327	Literr-Urban land-Merbeth complex, 9 to 15 percent slopes
330	Montavista clay loam, 15 to 30 percent slopes	330	Montavista clay loam, 15 to 30 percent slopes
331	Urbanland-Montavista complex, 15 to 30 percent slopes	331	Urban land-Montavista complex, 15 to 30 percent slopes
332	Urbanland-Montavista complex, 2 to 9 percent slopes	332	Urban land-Montavista complex, 2 to 9 percent slopes
333	Montavista-Togasara complex, 9 to 15 percent slopes	333	Montavista-Togasara complex, 9 to 15 percent slopes
334	Urban Land-Montavista-Togasara complex, 9 to 15 percent slopes	334	Urban land-Montavista-Togasara complex, 9 to 15 percent slopes
335	Montavista-Togasara complex, 2 to 9 percent slopes	335	Montavista-Togasara complex, 2 to 9 percent slopes
336	Togasara-Montavista complex, 2 to 9 percent slopes	335	Montavista-Togasara complex, 2 to 9 percent slopes
337	Urban Land-Togasara-Montavista complex, 2 to 9 percent slopes	337	Urban land-Togasara-Montavista complex, 2 to 9 percent slopes
338	Urban Land-Togasara-Montavista complex, 9 to 15 percent slopes	334	Urban land-Montavista-Togasara complex, 9 to 15 percent slopes
339	Togasara-Montavista complex, 15 to 30 percent slopes	339	Togasara-Montavista complex, 15 to 30 percent slopes

Field and Publication Names and Symbols -- continued.

Field symbols	Field map unit name	Publi-cation symbol	Approved map unit name
340	Lithic Haploxerolls-Kawenga-Rock Outcrop complex, 15 to 40 percent slopes	391	Kawenga-Lodo complex, 15 to 30 percent slopes
341	Lithic Haploxerolls-Rock Outcrop complex, 40 to 65 percent slopes	392	Lodo-Rock outcrop complex, 50 to 75 percent slopes
345	Argixerolls, 20 to 50 percent slopes	345	Argixerolls, 20 to 50 percent slopes
350	Urban Land-Togasara-Montavista complex, 15 to 30 percent slopes	350	Urban land-Togasara-Montavista complex, 15 to 30 percent slopes
351	Urbanland-Montavista-Togasara complex, 2 to 9 percent slopes	337	Urban land-Togasara-Montavista complex, 2 to 9 percent slopes
360	Altamont-Alo complex, 15 to 30 percent slopes	305	Alo-Altamont complex, 15 to 30 percent slopes
365	Unistan-Rock outcrop complex, 5 to 9 percent slopes	365	Unistan-Rock outcrop complex, 5 to 9 percent slopes
366	Unistan-Rock outcrop complex, 15 to 30 percent slopes	366	Unistan-Rock outcrop complex, 15 to 30 percent slopes
367	Urban land-Unistan complex, 15 to 30 percent slopes	367	Urban land-Unistan complex, 15 to 30 percent slopes
368	Urbanland-Unistan complex, 9 to 15 percent slopes	368	Urban land-Unistan complex, 9 to 15 percent slopes
370	Zeppelin-Mccoy complex, 5 to 9 percent slopes	370	Zeppelin-Mccoy complex, 5 to 9 percent slopes
371	Zeppelin-Mccoy complex, 15 to 30 percent slopes	371	Zeppelin-Mccoy complex, 15 to 30 percent slopes
375	Alumrock-Zepplin complex, 15 to 30 percent slopes	375	Alumrock-Zepplin complex, 15 to 30 percent slopes
376	Zeppelin-Alumrock complex, 30 to 50 percent slopes	376	Zeppelin-Alumrock complex, 30 to 50 percent slopes
377	Alumrock fine sandy loam, 15 to 30 percent slopes	377	Alumrock fine sandy loam, 15 to 30 percent slopes
378	Urbanland-Alumrock-Zeppelin complex, 9 to 15 percent slopes	378	Urban land-Alumrock-Zeppelin complex, 9 to 15 percent slopes
379	Urbanland-Alumrock complex, 9 to 15 percent slopes	379	Urban land-Alumrock complex, 9 to 15 percent slopes
380	Lodo-Zepplin complex, 30 to 50 percent slopes	380	Lodo-Zepplin complex, 30 to 50 percent slopes
385	Alo-Altamont complex, 9 to 15 percent slopes	385	Alo-Altamont complex, 9 to 15 percent slopes
386	Alumrock-Zeppelin complex, 9 to 15 percent slopes	386	Alumrock-Zeppelin complex, 9 to 15 percent slopes
389	Rock Outcrop, 30 to 50 percent slopes	390	Rock outcrop-Lodo complex, 50 to 75 percent slopes
390	Rock outcrop-Lodo complex, 50 to 75 percent slopes	390	Rock outcrop-Lodo complex, 50 to 75 percent slopes
391	Kawenga-Lodo complex, 15 to 30 percent slopes	391	Kawenga-Lodo complex, 15 to 30 percent slopes
392	Lodo-Rock outcrop complex, 50 to 75 percent slopes	392	Lodo-Rock outcrop complex, 50 to 75 percent slopes
400	Diablo clay, 9 to 15 percent slopes	400	Diablo clay, 9 to 15 percent slopes
401	Gaviota loam, 15 to 30 percent slopes	401	Gaviota loam, 15 to 30 percent slopes
402	Gaviota loam, 30 to 75 percent slopes	402	Gaviota loam, 30 to 75 percent slopes
403	Gaviota gravelly loam, 30 to 75 percent slopes, eroded	403	Gaviota gravelly loam, 30 to 75 percent slopes, eroded
404	Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded	404	Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded
405	Gaviota-Los Gatos complex, 30 to 50 percent slopes	405	Gaviota-Los Gatos complex, 30 to 50 percent slopes
406	Los Gatos gravelly loam, 50 to 75 percent slopes	406	Los Gatos gravelly loam, 50 to 75 percent slopes

Field and Publication Names and Symbols -- continued.

Field symbols	Field map unit name	Publi-cation symbol	Approved map unit name
407	Los Gatos-Gaviota complex, 50 to 75 percent slopes	407	Los Gatos-Gaviota complex, 50 to 75 percent slopes
408	Vallecitos rocky loam, 15 to 30 percent slopes, eroded	408	Vallecitos rocky loam, 15 to 30 percent slopes, eroded
409	Zamora loam, 2 to 9 percent slopes	409	Zamora loam, 2 to 9 percent slopes
501	Limemountain-Rock outcrop, limestone complex, 15 to 30 percent slopes	575	Mouser-Footpath complex, 8 to 30 percent slopes
502	Limemountain-Rock outcrop, limestone complex, 50 to 75 percent slopes	575	Mouser-Footpath complex, 8 to 30 percent slopes
505	Casrock sandy loam, conglomerate bedrock, 15 to 30 percent slopes	505	Casrock sandy loam, conglomerate bedrock, 15 to 30 percent slopes
510	Casrock-Skyridge-Rock outcrop complex, 8 to 30 percent slopes	510	Casrock-Skyridge-Rock outcrop complex, 8 to 30 percent slopes
515	Ben Lomond gravelly sandy loam, 50 to 74 percent slopes	518	Ben Lomond-Casrock complex, 50 to 75 percent slopes
516	Ben Lomond gravelly sandy loam, 15 to 30 percent slopes	516	Ben Lomond gravelly sandy loam, 15 to 30 percent slopes
517	Ben Lomond-Casrock complex, 30 to 50 percent slopes	517	Ben Lomond-Casrock complex, 30 to 50 percent slopes
518	Ben Lomond-Casrock complex, 50 to 75 percent slopes	518	Ben Lomond-Casrock complex, 50 to 75 percent slopes
519	Ben Lomond-Felton complex, 30 to 75 percent slopes	519	Ben Lomond-Felton complex, 30 to 75 percent slopes
520	Mouser-Maymen complex, 30 to 75 percent slopes	520	Mouser-Maymen complex, 30 to 75 percent slopes
525	Felton fine sandy loam, 30 to 50 percent slopes	525	Felton fine sandy loam, 30 to 50 percent slopes
530	Aptos loam, 15 to 30 percent slopes	530	Aptos loam, 15 to 30 percent slopes
531	Aptos Loam, 30 to 50 percent slopes	531	Aptos Loam, 30 to 50 percent slopes
550	Plaskett-Gamboa complex, 30 to 75 percent slopes	520	Mouser-Maymen complex, 30 to 75 percent slopes
551	Maymen-Katykat complex, 8 to 30 percent slopes	551	Maymen-Katykat complex, 8 to 30 percent slopes
552	Elsman-Maymen-Sanikara, 30 to 50 percent slopes	552	Elsman-Maymen-Sanikara, 30 to 50 percent slopes
553	Elsman-Maymen, 50 to 75 percent slopes	553	Elsman-Maymen, 50 to 75 percent slopes
559	Ratonero-Footpath complex, 15 to 50 percent slopes	560	Katykat-Mouser-Sanikara complex, 30 to 50 percent slopes
560	Katykat-Mouser-Sanikara complex, 30 to 50 percent slopes	560	Katykat-Mouser-Sanikara complex, 30 to 50 percent slopes
561	Footpath-Mouser complex, 30 to 50 percent slopes	561	Footpath-Mouser complex, 30 to 50 percent slopes
563	Montara, 45 to 60 percent slopes	301	Montara sandy loam, 15 to 50 percent slopes
564	Santerhill-Xerolls-Mouser complex, 15 to 30 percent slopes, mined land	564	Santerhill-Xerolls-Mouser complex, 15 to 30 percent slopes, mined land
565	Pits, mercury mine	564	Santerhill-Xerolls-Mouser complex, 15 to 30 percent slopes, mined land
566	Mouser-Katykat-Sanikara complex, 50 to 75 percent slopes	566	Mouser-Katykat-Sanikara complex, 50 to 75 percent slopes
567	Sanikara-Mouser-Rock outcrop complex, 50 to 75 percent slopes	567	Sanikara-Mouser-Rock outcrop complex, 50 to 75 percent slopes
568	Golfcart-Maygat complex, 8 to 30 percent slopes	569	Katykat-Sanikara complex, 8 to 30 percent slopes
569	Katykat-Sanikara complex, 8 to 30 percent slopes	569	Katykat-Sanikara complex, 8 to 30 percent slopes
570	Footpath-Mouser complex, 50 to 75 percent slopes	570	Footpath-Mouser complex, 50 to 75 percent slopes

Field and Publication Names and Symbols -- continued.

Field symbols	Field map unit name	Publi-cation symbol	Approved map unit name
571	Sanikara-Rock Outcrop complex, 75 to 100 percent slopes	571	Sanikara-Rock Outcrop complex, 75 to 100 percent slopes
572	Ordeal-Longsfolly-Passion complex, 35 to 50 percent slopes	560	Katykat-Mouser-Sanikara complex, 30 to 50 percent slopes
575	Mouser-Footpath complex, 8 to 30 percent slopes	575	Mouser-Footpath complex, 8 to 30 percent slopes
576	Sanikara-Footpath complex, 30 to 75 percent slopes	576	Sanikara-Footpath complex, 30 to 75 percent slopes
580	Maymen gravelly sandy clay loam, 30 to 50 percent slopes	580	Maymen gravelly sandy clay loam, 30 to 50 percent slopes
581	Maymen gravelly sandy clay loam, 50 to 75 percent slopes	581	Maymen gravelly sandy clay loam, 50 to 75 percent slopes
DAM	Large dams	DAM	Large dams
W	Water	W	Water

5. Series Established by This Correlation.

NEW SOIL SERIES ESTABLISHED with this Correlation

04/30/2009

Santa Clara Area, California, Western Part

Soil name	Family or higher taxonomic class
Airship	Loamy-skeletal, mixed, superactive, thermic Typic Haploxerepts
Alumrock	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Caninecreek	Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls
Casrock	Loamy-skeletal, mixed, superactive, mesic Pachic Ultic Haploxerolls
Elpaloalto	Fine-silty, smectitic, superactive, thermic Pachic Haploxerolls
Elsman	Loamy-skeletal, mixed, superactive, mesic Typic Haploxerepts
Embarcadero	Fine, mixed, active, calcareous, thermic Fluventic Endoaquolls
Flaskan	Fine-loamy, mixed, superactive, thermic Typic Argixerolls
Footpath	Fine-loamy, mixed, superactive, mesic Pachic Argixerolls
Hangerone	Fine, smectitic, thermic Cumulic Vertic Endoaquolls
Katykat	Fine-loamy, mixed, superactive, mesic Ultic Haploxeralfs
Landelspark	Fine-loamy, mixed, superactive, thermic Fluventic Haploxerolls
Literr	Fine, mixed, superactive, thermic Pachic Argixerolls
Merbeth	Fine, mixed, superactive, thermic Mollic Palexeralfs
Minlum	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Montavista	Fine, smectitic, thermic Typic Argixerolls
Mouser	Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls
Newpark	Fine-silty, mixed, superactive, thermic Calcic Pachic Haploxerolls
Santerhill	Fine, magnesic, thermic Aridic Haploxererts
Skyridge	Loamy, mixed, superactive, mesic Lithic Ultic Haploxerolls
Stevenscreek	Fine-loamy, mixed, superactive, thermic Pachic Haploxerolls
Togasara	Loamy-skeletal, mixed, superactive, thermic Typic Argixerolls
Unistan	Clayey-skeletal, smectitic, thermic Lithic Haploxerolls
Zeppelin	Fine, smectitic, thermic Pachic Argixerolls

6. Series Dropped or Made Inactive.

None

7. Cooperators' Names and Credits.

United States Department of Agriculture, Natural Resources Conservation Service

In cooperation with

Regents of the University of California, Agriculture and Natural Resources (Agricultural Experiment Station).

The credits to be given in the published soil survey are as follows:

This survey was made for the National Cooperative Soil Survey by the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with and with assistance from the Regents of the University of California, Agriculture and Natural Resources (Agricultural Experiment Station); the Guadalupe-Coyote Resource Conservation District; the Mid-Peninsula Regional Open Space District; the Santa Clara County Parks and Recreation Department; the Santa Clara County Open Space Authority; and Stanford University.

Acknowledgement is also rendered for the many cities and towns within the survey area who granted permission for the soil survey to be conducted on their public lands including: Campbell, Cupertino, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Mountain View, Palo Alto, Santa Clara, San Jose, Saratoga, and Sunnyvale.

The survey is part of the technical assistance furnished by the Natural Resources Conservation Service, Hollister, California Office to the Guadalupe-Coyote Resource Conservation District.

8. Prior Soil Survey Publications.

Soil Survey, Santa Clara Area, California; United States Department of Agriculture, Soil Conservation Service; Series 1941, No. 17; June 1958

Soils of Santa Clara County (Supplemental Report); United States Department of Agriculture, Soil Conservation Service; 1968

9. Miscellaneous Items.

10. Instructions for Map Development.

- The geodatabase was developed by Bill Reed, Valerie Bullard, and Kit Paris with special assistance by Russell Alamaraz and David Howell.
- The base map was 2005 NAIP photography from APFO, Salt Lake City.
- The maps were digitized on-screen using ArcMap software.
- Spatial data will be sent to the Montana Digitizing Center for SSURGO certification.
- No layers will be used for point, special features or lines.
- Detailed instructions for map compilation are found in NSSH Part 647.
- A General Soils Map will be developed from aggregation of the detailed soils map SSURGO product after the SSURGO has been certified.

Changes to Data Map Finishing Specifications.

All map features have been completed according to the "Digital Map Finishing and Print on Demand Maps User Guide" prepared by the NRCS-National Cartographic and Geospatial Center in Ft. Worth, Texas, except for those modifications noted below.

Data Layers

Geographic Area Names – Populated Places (Cities) – Text is bold.
Geographic Area Names – Non-populated Places (Airports, Schools, Other Places) – Text is bold
Road Names (Expressways) – Text is bold
Roads – Highways
U.S. Interstate HWY – Symbol size is 24 (unchecked Symbol Marker to fit text)
U.S. Route HWY and State Route HWY – Symbol size is 17 (unchecked Symbol Marker to fit text)
Hydrography – No lines; Text is black and bold

Soil Labels (Soil Intersect Layer) – Text is Black, Bold. Leaders are Black, Bold, Line is .4
Other Annotation
Limit of Soil Survey Label: Text – Black, Arial 8, Bold.
Data for this area... Label: Text – Gray 10%, Arial 8, Italics, Bold.

11. Feature and Symbol Legend.

NRCS-SOI-37a
REVISED MAY 2001

Soil Survey Area Kern County, California, Southwest Part CA691_

State _California

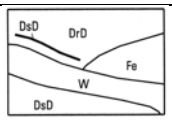
FEATURE AND SYMBOL LEGEND FOR SOIL SURVEY

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Date: May 29, 2008_____

SOIL SURVEY FEATURES

SOIL DELINEATIONS AND LABELS	
Limit of soil survey (label) and/or denied access area	Label

STANDARD LANDFORM AND MISCELLANEOUS SURFACE FEATURES – Not Used

~~Bedrock escarpment~~	
~~Non-bedrock escarpment~~	
~~Gully~~	
~~Levee~~	
~~Short steep slope~~	
~~Blowout~~	
~~Borrow pit~~	
~~Clay spot~~	
~~Closed depression~~	
~~Gravel pit~~	
~~Gravely spot~~	
~~Landfill~~	
~~Lava flow~~	
~~Marsh or swamp~~	
~~Mine or quarry~~	
~~Miscellaneous water~~	
~~Perennial water~~	
~~Rock outcrop~~	
~~Saline spot~~	
~~Sandy spot~~	
~~Severely eroded spot~~	
~~Sinkhole~~	
~~Slide or slip~~	
~~Sodic spot~~	
~~Spoil area~~	
~~Stony spot~~	
~~Very stony spot~~	
~~Wet spot~~	

AD HOC FEATURES NOT USED

~~SFP~~	~~1~~	
	~~2~~	
	~~3~~	
~~DUR~~	~~4~~	
	~~5~~	
~~FUM~~	~~6~~	
	~~7~~	
	~~8~~	
	~~9~~	
	~~10~~	
	~~11~~	
	~~12~~	
~~BOM~~	~~13~~	
	~~14~~	
	~~15~~	
	~~16~~	
	~~17~~	
	~~18~~	
	~~19~~	
~~BCH~~	~~20~~	
	~~21~~	
	~~22~~	
	~~23~~	
~~ALD~~	~~24~~	
	~~25~~	
~~SAS~~	~~26~~	
~~TYP~~	~~27~~	
	~~28~~	
	~~29~~	
~~SWA~~	~~30~~	
	~~31~~	
	~~32~~	
	~~33~~	
~~SER~~	~~34~~	
~~COB~~	~~35~~	
	~~36~~	
	~~37~~	
	~~38~~	
	~~39~~	
~~TER~~	~~40~~	
~~SDL~~	~~41~~	
~~DET~~	~~42~~	
~~KIP~~	~~43~~	
	~~44~~	

CULTURAL FEATURES (Optional)

As highlighted on Topographic maps

National, state or providence	
~~County or parish~~	
~~County or parish~~	
Reservation (national or state forest or park)	
Field sheet matchline and neatline	
Public Land Survey System Section Boundary	
Public Land Survey System Section Corner Tics.	

TRANSPORTATION

Labeled only

~~Divided road Normally not shown~~	Label Only
~~Other road Normally not shown~~	
~~Trail Normally not shown~~	

ROAD EMBLEMS

Interstate	
Federal	
State	
County, farm or ranch	

LOCATED OBJECTS

Not Used

Airport, airfield	Label Only
~~Cemetery~~	
~~Church~~	
~~Farmstead, house (omit in urban areas)~~	
~~Lighthouse~~	
~~Located object (Label)~~	Ranger Station
~~Lookout tower~~	
~~Oil and/or natural gas well~~	
~~Other Religion (label)~~	Mt. Carmel
~~School~~	
~~Soil sample site (compiled only not published)~~	
~~Tank (label)~~	Petroleum
~~Windmill~~	

HYDROGRAPHIC FEATURES (Optional)

NOT USED

~~Drainage end (indicates direction of flow)~~	
~~Perennial stream~~	
~~Intermittent stream~~	
~~Unclassified stream~~	
~~Perennial drainage or irrigation ditch~~	
~~Intermittent drainage or irrigation ditch~~	
~~Unclassified drainage or irrigation ditch~~	
~~Flood pool line~~	FLOOD POOL LINE
~~Spring~~	
~~Well, artesian~~	
~~Well, irrigation~~	

OTHER FEATURES TO INCLUDE

State Coordinate Tics
Geographic Coordinate Tics
Small and medium dams

FEATURE AND SYMBOL LEGEND FOR SOIL SURVEY (Continued)

SPECIAL SYMBOLS FOR SOIL SURVEY AND SSURGO

NOT USED

LABEL	NAME	DESCRIPTION
~~BLO~~	~~Blowout~~	~~A small saucer-, cup-, or trough-shaped hollow or depression formed by wind erosion on a preexisting sand deposit. Typically _____to _____acres.~~
~~BPI~~	~~Borrow pit~~	~~An open excavation from which soil and underlying material have been removed usually for construction purposes. Typically ___2__to ___5__acres.~~
~~CLA~~	~~Clay spot~~	~~A spot where the surface layer is silty clay or clay in areas where the surface layer of the named soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.~~
~~DEP~~	~~Depression, closed~~	~~A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and is without a natural outlet for surface drainage. Typically _____to _____acres.~~
~~ESB~~	~~Escarpment, bedrock~~	~~A relatively continuous and steep slope or cliff produced by erosion or faulting, which breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.~~
~~ESO~~	~~Escarpment, other~~	~~A relatively continuous and steep slope or cliff that generally is produced by erosion but can be produced by faulting, which breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.~~
~~GPI~~	~~Gravel pit~~	~~An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel. Typically _____to _____acres.~~
~~GRA~~	~~Gravelly spot~~	~~A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area of surrounding soil with less than 15 percent fragments. Typically _____to _____acres.~~
~~GUL~~	~~Gully~~	~~A small channel with steep sides cut by running water and through which water ordinarily runs only after a rain or after ice or snow melts. It generally is an obstacle to wheeled vehicles and is too deep to be obliterated by ordinary tillage.~~
~~LDF~~	~~Landfill~~	~~An area of accumulated waste products of human habitation that can be above or below natural ground level. Typically __2___to __5___acres.~~
~~LAV~~	~~Lava flow~~	~~A solidified body of rock formed through lateral, surficial outpouring of molten lava from a vent or fissure. Often lobate in shape. Typically _____to _____acres.~~
~~LVS~~	~~Levee~~	~~An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow on lowlands.~~
~~MAR~~	~~Marsh or swamp~~	~~A water-saturated, very poorly drained area, intermittently or permanently covered by water. Marsh areas are dominantly vegetated by sedges, cattails, and rushes. Swamps are dominantly vegetated by trees or shrubs. Not used in map units where poorly drained or very poorly drained soils are the named components. Typically _____to _____acres.~~
~~MPI~~	~~Mine or quarry~~	~~An open excavation from which soil and underlying material are removed and bedrock is exposed. Also denotes surface openings to underground mines. Typically _____to _____acres.~~
~~MIS~~	~~Miscellaneous water~~	~~Small, man-made water area that is used for industrial, sanitary, or mining applications and contains water most of the year. Typically _____to _____acres.~~
~~WAT~~	~~Perennial water~~	~~Small, natural or man-made lake, pond, or pit that contains water most of the year. Typically _____to _____acres.~~
~~ROC~~	~~Rock outcrop~~	~~An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where "bedrock" is a named component of the map unit. Typically _____to _____acres.~~
~~SAL~~	~~Saline spot~~	~~An area where the surface layer has an electrical conductivity of 8 mmhos cm-1 more than the surface layer of the named soils in the surrounding map unit, which have an EC of 2 mmhos cm-1 or less. Typically _____to _____acres.~~
~~SAN~~	~~Sandy spot~~	~~A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils of the surrounding map unit is very fine sandy loam or finer.~~

ERO..... Severely eroded spot.....An area where on the average 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units with component phases that are named severely eroded, very severely eroded, or gullied.

SLP..... Short, steep slope.....Narrow soil area that has slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

SNK..... Sinkhole.....A closed depression formed either by solution of the surficial rock or by collapse of underlying caves. Typically _____to _____acres.

SLI..... Slide or slip.....A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces. Typically _____to _____acres.

SOD..... Sodic spot.....An area where the surface layer has a sodium adsorption ratio that is at least 10 more than the surface layer of the named soils in the surrounding map unit, which have a sodium adsorption ratio of 5 or less. Typically _____to _____acres.

SPO..... Spoil area.....A pile of earthy materials, either smoothed or uneven, resulting from human activity. Typically _____to _____acres.

STN..... Stony spot.....A spot where 0.01 to 0.1 percent of the surface is covered with rock fragments that are greater than 10 inches in diameter in areas where the surrounding soil has no surface stones. Typically _____to _____acres.

STV..... Very stony spot.....A spot where 0.1 to 3 percent of the surface is covered with rock fragments that are greater than 10 inches in diameter in areas where less than 0.01 percent of the surface of the surrounding soil is covered with stones. Typically _____to _____acres.

WET..... Wet spot.....A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit. Typically _____to _____acres.

AD HOC SYMBOLS

For

Pacific Southwest MLRA Region 2

04/01

LABEL NAME DESCRIPTION

BCH 20 .. Beaches.....A gently sloping zone, typically with a concave profile, of unconsolidated material extending landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff)

BOM 13 Bomb crater .....A bowl shaped hole in the ground between 10 to 25 feet in diameter and between 7 and 15 feet deep caused by aerial bombs or naval guns. Typically .05 to .10 acres.

COB 35 . Cobbly spot.....Surface layer has more than 35 percent, by volume, of rock fragments 3 to 10 inches in diameter in areas where less than 0.01 percent of the surface of the surrounding soil is covered with cobbles. Typically 0 to 5 acres.

DET 42 . Detrimental deposits .....Areas of spreading or deposits of cement dust, cement, or other types of materials that, when on the surface, inhibit the growth of plants, and make classification of the underlying soil impractical. Typically 0 to 5 acres.

DUR 4 ... Duripan.....The duripan is a subsurface horizon that is cemented by illuvial silica to the degree that is less than 50 percent of the volume of air-dry fragments that slake in water or during prolonged soaking in acid (HCL). Typically 0 to 5 acres.

FUM 6... Fumarole.....A volcanic vent emitting steam or gases, or any other localized expression of geothermal dynamics. Typically 3 to .6 acres.

KIP 43... Kipuka .....An island in the midst of a lava flow that escaped burial by the flowing lava because the lava was diverted around it. Typically .5 to 1.0 acres.

SAS 26 .. Saline sodic spot .....Surface layer with a sodium adsorption ration that is 10 or more and an electrical conductivity of 8 decisiemens more than the surface layer of the named soils in the surrounding map unit, which has a sodium adsorption ratio of 5 or less and which has and EC of 4 decisiemens/meter or less. Typically 0 to 5 acres.

SDL 41 ... Sandy loam surface.....A spot where the surface layer is sandy loam in areas where the surface layer of the named soils of the surrounding map unit is loamy fine sand or coarser. Typically 0 to 5 acres.

SWA 30. Seasonal water table.....A water table which has been altered by seepage from irrigation. Not used where the major components have the same characteristics. Typically 0 to 5 acres.

SER 34.. Serpentine outcrop.....An exposure of serpentinitic bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock. Typically 0 to 5 acres.

SFP 1..... Short, flat slope.....Narrow soil area that has slopes that are at leas 2 slope classes less than the slope class of the surrounding map unit. Typically 0 to 5 acres.

TER 40 . Terrace remnant.....A fan remnant or stream terrace that remains or is left standing above the general land surface after erosion has reduced the surrounding area. Typically 0 to 5 acres.

TYP 27.. Series Type Location .....Location of the soil series typical pedon.

ALD 24 . Alluvial Deposit.....Deposits of alluvial material too small to be delineated ....surrounded by non-alluvial areas

12. General Soil Map Unit Legend.

GENERAL SOIL MAP LEGEND

SOILS IN MARSHES, TIDALLY FLOODED AND PROTECTED

1. **Novato, excessive salinity-Novato**

   Very deep, nearly level, very poorly drained soils formed in fine textured alluvium from mixed rock sources, in tidal marshes.

   Map Units: 110, 111, 112, 120, 121, 155, 156, 157

SOILS IN BASINS AND BASIN RIMS

2. **Urban land-Hangerone**

   Very deep, nearly level, poorly drained soils formed in fine textured alluvium from mixed rock sources, in basins and on basin rims.

   Map Units: 101, 113, 122, 123, 145, 146, 160, 161, 185

LOWER ALLUVIAL FANS AND FLOOD PLAINS

3. **Urban land-Elpaloalto-Campbell**

   Very deep, gently sloping, well and moderately well drained soils formed in alluvium from mixed rock sources, on alluvial fans and on flood plains.

   Map Units: 102, 129, 130, 131, 135, 136, 137, 150, 151, 165, 166, 168, 169, 170, 171, 173, 174, 178, 180, 181, 409

UPPER ALLUVIAL FANS

4. **Urban land-Flaskan-Botella**

   Very deep, gently to moderately sloping, well drained soils formed in alluvium from mixed rock sources, on alluvial fans.

   Map Units: 140, 141, 142, 143, 144, 147, 175, 176, 177, 190

SOILS ON TERRACES

5. Urban land-Literr-Montavista

Very deep, strongly to steeply sloping, well drained soils formed in old alluvium from mixed rock sources, on eroded terraces.

Map Units: 320, 321, 322, 323, 324, 326, 327, 330, 331, 332, 333, 334, 335, 337, 389, 350

SOILS ON ULTRAMAFIC FOOTHILLS OF THE SANTA CRUZ MOUNTAINS AND DIABLO RANGES

6. Montara-Santerhill

Shallow and deep, strongly to steeply sloping, well drained soils formed in residuum from serpentinite, on hillslopes and mountain slopes.

Map Units: 300, 301, 302, 303, 304, 308

SOILS ON SEDIMENTARY FOOTHILLS OF THE SANTA CRUZ MOUNTAINS AND DIABLO RANGES

7. Alo-Urban land-Altamont-Cropley

Moderately deep, deep, and very deep, gently to steeply sloping, well drained soils formed from residuum and alluvium from sandstone and shale, on hillslopes and mountain slopes.

Map Units: 305, 306, 307, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 345, 365, 366, 367, 368, 370, 371, 375, 376, 377, 378, 379, 380, 385, 386

SOILS EAST OF THE SAN ANDREAS FAULT IN THE SANTA CRUZ MOUNTAINS

8. Sanikara-Mouser-Katykat-Elsman

Shallow, deep and very deep, strongly to steeply sloping, well drained soils formed from residuum form sandstone, mudstone, and greenstone, on hillslopes and mountain slopes

Map Units: 115, 520, 551, 552, 553, 560, 561, 564, 566, 567, 569, 570, 571, 575, 576, 580, 581

SOILS WEST OF THE SAN ANDREAS FAULT IN THE SANTA CRUZ MOUNTAINS

9. Ben Lomond-Casrock

Moderately deep and deep, strongly to steeply sloping, well drained soils formed from residuum from arkrosic sandstone, on hillslopes and mountain slopes.

Map Units: 505, 510, 516, 517, 518, 519, 525, 530, 531

SOILS IN THE MOUNTAINS OF THE DIABLO RANGES EAST OF SANTA CLARA VALLEY

10. Gaviota-Vallecitos

Shallow and moderately deep, strongly to steeply sloping, well drained soils formed from residuum from sandstone and shale, on hillslopes and mountain slopes.

Map Units: 391, 392, 395, 400, 401, 402, 403, 404, 405, 406, 407, 408

13. Conversion Legend.

Soil Mapunit Symbol Conversion Legend

Santa Clara Area, California, Western Part: Detailed Soil Map Legend

Field symbols	Publication symbol
100	101
101	101
102	102
110	110
110sc	110sc
111	111
112	112
113	113
115	115
116sc	116sc
120	120
121	121
122	122
123	123
129	129
130	130
131	131
135	135
136	136
137	137
140	140
141	141
142	142
142sc	142sc
143	143
143sc	143sc
144	144
145	145
146	146
149sc	149sc
150	150
150sc	150sc
151	151
151sc	151sc
155	155
156	156
157	157
160	160
161	161
165	165
166	166
168	168
169	169
170	170
171	171
172	171
173	173
174	174
175	175
176	176
177	177
178	178
180	180
181	181
185	185
190	190
300	300
301	301
302	302
303	303
304	304
305	305
306	306
307	307
308	308
309	309
310	310
311	311
312	312
313	313
314	314
315	315
316	316
317	317
318	318
320	320
321	321
322	322
323	323
324	324
325	320
326	326
327	327
330	330
331	331
332	332
333	333

Field symbols	Publication symbol
334	334
335	335
336	335
337	337
338	334
339	339
340	391
341	392
345	345
350	350
351	337
360	305
365	365
366	366
367	367
368	368
370	370
371	371
375	375
376	376
377	377
378	378
379	379

Field symbols	Publication symbol
380	380
385	385
386	386
389	390
390	390
391	391
392	392
400	400
401	401
402	402
403	403
404	404
405	405
406	406
407	407
408	408
409	409
501	575
502	575
505	505
510	510
515	518
516	516
517	517
518	518

Field symbols	Publication symbol
519	519
520	520
525	525
530	530
531	531
550	520
551	551
552	552
553	553
559	560
560	560
561	561
563	301
564	564
565	564
566	566
567	567
568	569
569	569
570	570
571	571
572	560
575	575
576	576
580	580
581	581
DAM	DAM
W	W

14a Legend of Map Units in Numerical Sequence.

NUMERICAL WORKING LEGEND
Santa Clara Area, California, Western Part: Detailed Soil Map Legend

Map symbol	Map unit name
101	Urban land, 0 to 2 percent slopes, basins
102	Urban land, 0 to 2 percent slopes, alluvial fans
110	Xerorthents, trash substratum, 0 to 2 percent slopes
110sc	Ben Lomond sandy loam, 5 to 15 percent slopes
111	Xerorthents, trash substratum, 9 to 15 percent slopes
112	Xerorthents, trash substratum 15 to 30 percent slopes
113	Xerorthents, trash substratum, 30 to 50 percent slopes
115	Pits, mine
116sc	Bonnydoon loam, 5 to 30 percent slopes
120	Aquic Xerorthents, bay mud subtratum, 0 to 2 percent slopes
121	Aquic Xerorthents, bay mud substratum, 2 to 5 percent slopes
122	Xerorthents, anthropogenic fill, 0 to 2 percent slopes
123	Urban Land-Xerorthents, anthropogenic fill complex, 0 to 2 percent slopes
129	Urban land-Still complex, 2 to 5 percent slopes
130	Urban land-Still complex, 0 to 2 percent slopes
131	Urban land-Elpaloalto complex, 0 to 2 percent slopes
135	Urban land-Stevenscreek complex, 0 to 2 percent slopes
136	Urban land-Stevenscreek complex, 2 to 9 percent slopes
137	Stevenscreek sandy clay loam, 0 to 2 percent slopes
140	Urban land-Flaskan complex, 0 to 2 percent slopes
141	Urban land-Flaskan complex, 2 to 9 percent slopes
142	Flaskan sandy loam, 15 to 30 percent slopes
142sc	Lompico-Felton complex, 5 to 30 percent slopes
143	Flaskan sandy clay loam, 5 to 9 percent slopes
143sc	Lompico-Felton complex, 30 to 50 percent slopes
144	Flaskan sandy clay loam, 0 to 2 percent slopes
145	Urban land-Hangerone complex, 0 to 2 percent slopes, drained
146	Hangerone clay loam, drained, 0 to 2 percent slopes
149sc	Madonna loam, 15 to 30 percent slopes
150	Urban land-Embarcadero complex, 0 to 2 percent slopes, drained
150sc	Maymen stony loam, 15 to 30 percent slopes
151	Embarcadero silty clay loam, drained, 0 to 2 percent slopes
151sc	Maymen stony loam, 30 to 75 percent slopes
155	Novato clay, 0 to 1 percent slopes, tidally flooded
156	Novato silty clay loam, excessive salinity, 0 to 1 percent slopes, protected
157	Novato clay, 0 to 1 percent slopes, protected
160	Urban land-Clear Lake complex, 0 to 2 percent slopes
161	Clear Lake silty clay, 0 to 2 percent slopes, drained
165	Urban land-Campbell complex, 0 to 2 percent slopes, protected
166	Campbell silt loam, 0 to 2 percent slopes, protected
168	Elder fine sandy loam, protected, 0 to 2 percent slopes
169	Urban land-Elder complex, 0 to 2 percent slopes, protected
170	Urban land-Landelspark complex, 0 to 2 percent slopes
171	Elder fine sandy loam, 0 to 2 percent slopes, rarely flooded
173	Caninecreek-Elder complex, 0 to 2 percent slopes, rarely flooded
174	Urban land-Caninecreek-Elder complex, 0 to 2 percent slopes
175	Urbanland-Botella complex, 0 to 2 percent slopes
176	Urban land-Botella complex, 2 to 9 percent slopes
177	Urban land-Botella complex, 9 to 15 percent slopes
178	Caninecreek-Elder complex, 1 to 5 percent slopes, protected
180	Urban land-Newpark complex, 0 to 2 percent slopes
181	Newpark silty clay loam, 0 to 2 percent slopes
185	Bayshore, drained, 0 to 2 percent slopes
190	Cumulic Haploxerolls, 1 to 5 percent slopes
300	Urban land-Montara complex, 15 to 30 percent slopes
301	Montara sandy loam, 15 to 50 percent slopes
302	Montara-Rock outcrop complex, 30 to 50 percent slopes
303	Montara-Santerhill complex, 15 to 30 percent slopes
304	Montara-Santerhill complex, 30 to 50 percent slopes
305	Alo-Altamont complex, 15 to 30 percent slopes
306	Alo-Altamont complex, 30 to 50 percent slopes
307	Kawenga-Alo complex, 20 to 40 percent slopes
308	Urban land-Santerhill-Montara complex, 9 to 15 percent slopes
309	Urban land-Altamont-Alo complex, 9 to 15 percent slopes
310	Diablo clay, 15 to 30 percent slopes
311	Diablo clay, 30 to 50 percent slopes
312	Diablo-Urban land complex, 9 to 15 percent slopes
313	Diablo-Urban land complex, 15 to 30 percent slopes
314	Urban land-Altamont-Alo complex, 15 to 30 percent slopes
315	Cropley clay, 0 to 2 percent slopes
316	Cropley clay, 2 to 9 percent slopes
317	Urban land-Cropley complex, 0 to 2 percent slopes
318	Urban land-Cropley complex, 2 to 9 percent slopes
320	Literr-Merbeth complex, 15 to 30 percent slopes
321	Merbeth-Literr complex, 30 to 65 percent slopes
322	Literr-Urban land-Merbeth complex, 15 to 30 percent slopes
323	Minlum-Airship-Literr complex, 40 to 65 percent slopes
324	Literr loam, 15 to 30 percent slopes

NUMERICAL WORKING LEGEND – continued

Santa Clara Area, California, Western Part: Detailed Soil Map Legend

Map symbol	Mapunit name
326	Airship-Minlum complex, 40 to 65 percent slopes
327	Literr-Urban land-Merbeth complex, 9 to 15 percent slopes
330	Montavista clay loam, 15 to 30 percent slopes
331	Urban land-Montavista complex, 15 to 30 percent slopes
332	Urban land-Montavista complex, 2 to 9 percent slopes
333	Montavista-Togasara complex, 9 to 15 percent slopes
334	Urban Land-Montavista-Togasara complex, 9 to 15 percent slopes
335	Montavista-Togasara complex, 2 to 9 percent slopes
337	Urban Land-Togasara-Montavista complex, 2 to 9 percent slopes
339	Togasara-Montavista complex, 15 to 30 percent slopes
345	Argixerolls, 20 to 50 percent slopes
350	Urban Land-Togasara-Montavista complex, 15 to 30 percent slopes
365	Unistan-Rock outcrop complex, 5 to 9 percent slopes
366	Unistan-Rock outcrop complex, 15 to 30 percent slopes
367	Urban land-Unistan complex, 15 to 30 percent slopes
368	Urban land-Unistan complex, 9 to 15 percent slopes
370	Zeppelin-Mccoy complex, 5 to 9 percent slopes
371	Zeppelin-Mccoy complex, 15 to 30 percent slopes
375	Alumrock-Zepplin complex, 15 to 30 percent slopes
376	Zeppelin-Alumrock complex, 30 to 50 percent slopes
377	Alumrock fine sandy loam, 15 to 30 percent slopes
378	Urban land-Alumrock-Zeppelin complex, 9 to 15 percent slopes
379	Urban land-Alumrock complex, 9 to 15 percent slopes
380	Lodo-Zepplin complex, 30 to 50 percent slopes
385	Alo-Altamont complex, 9 to 15 percent slopes
386	Alumrock-Zeppelin complex, 9 to 15 percent slopes
390	Rock outcrop-Lodo complex, 50 to 75 percent slopes
391	Kawenga-Lodo complex, 15 to 30 percent slopes
392	Lodo-Rock outcrop complex, 50 to 75 percent slopes
400	Diablo clay, 9 to 15 percent slopes
401	Gaviota loam, 15 to 30 percent slopes
402	Gaviota loam, 30 to 75 percent slopes
403	Gaviota gravelly loam, 30 to 75 percent slopes, eroded
404	Gaviota gravelly loam, 30 to 75 percent slopes, severely eroded
405	Gaviota-Los Gatos complex, 30 to 50 percent slopes
406	Los Gatos gravelly loam, 50 to 75 percent slopes
407	Los Gatos-Gaviota complex, 50 to 75 percent slopes
408	Vallecitos rocky loam, 15 to 30 percent slopes, eroded
409	Zamora loam, 2 to 9 percent slopes
505	Casrock sandy loam, conglomerate bedrock, 15 to 30 percent slopes
510	Casrock-Skyridge-Rock outcrop complex, 8 to 30 percent slopes
516	Ben Lomond gravelly sandy loam, 15 to 30 percent slopes
517	Ben Lomond-Casrock complex, 30 to 50 percent slopes
518	Ben Lomond-Casrock complex, 50 to 75 percent slopes
519	Ben Lomond-Felton complex, 30 to 75 percent slopes
520	Mouser-Maymen complex, 30 to 75 percent slopes
525	Felton fine sandy loam, 30 to 50 percent slopes
530	Aptos loam, 15 to 30 percent slopes
531	Aptos Loam, 30 to 50 percent slopes
551	Maymen-Katykat complex, 8 to 30 percent slopes
552	Elsman-Maymen-Sanikara, 30 to 50 percent slopes
553	Elsman-Maymen, 50 to 75 percent slopes
560	Katykat-Mouser-Sanikara complex, 30 to 50 percent slopes
561	Footpath-Mouser complex, 30 to 50 percent slopes
564	Santerhill-Xerolls-Mouser complex, 15 to 30 percent slopes, mined land
566	Mouser-Katykat-Sanikara complex, 50 to 75 percent slopes
567	Sanikara-Mouser-Rock outcrop complex, 50 to 75 percent slopes
569	Katykat-Sanikara complex, 8 to 30 percent slopes
570	Footpath-Mouser complex, 50 to 75 percent slopes
571	Sanikara-Rock Outcrop complex, 75 to 100 percent slopes
575	Mouser-Footpath complex, 8 to 30 percent slopes
576	Sanikara-Footpath complex, 30 to 75 percent slopes
580	Maymen gravelly sandy clay loam, 30 to 50 percent slopes
581	Maymen gravelly sandy clay loam, 50 to 75 percent slopes
DAM	Large dams
W	Water

15. Classification of Pedons Sampled for Laboratory Analysis.

Laboratory Data from the NSSC Soil Survey Laboratory, CA691

Sampled As	Pedon Sample Number	Pedon ID Number	Publication Symbol	Approved Series Name
Sunnyvale	07N0671	05CA085225	145	Hangerone
Embarcadero	07N0672	05CA085319	151	Embarcadero
Botella	07N0673	05CA085238	140	Flaskan
Elpaloalto	07N0675	05CA085227	131	Elpaloalto
Elder	07N0674	05CA085276	171	Elder
Maymen-like	07N0676	05CA08582	576	Sanikara
Mouser	07N0677	05CA08586	520	Mouser
Ben Lomond	07N0678	04CA085117	518	Ben Lomond
Novato	08N0091	03CA08564103	380	Novato

16. Sampled Pedons in Published Soil Survey Report.

No lab data will be included in the Soil Survey manuscript. Instead, a link to the National Soil Survey Laboratory will be provided with the appropriate reference lab numbers shown in Item 15. http://ssldata.sc.egov.usda.gov/

17. Notes to Accompany the Classification and Correlation of the Soils

Notes to Accompany Classification Santa Clara Soil Survey CA641

By Bill Reed

Santa Cruz Mountains.

There is a dramatic shift in soils across the San Andreas Fault throughout the soil survey area. On the west side, the bedrock is an acid sandstone and the soils are coarse-loamy and moderately to strongly acid. East of the fault, the bedrock is greenstone and sandstone of the Franciscan Formation and the soils are fine-loamy.

The area of these mountains above about 600 feet is mesic on north slopes; this was documented by a soil temperature transect with HOBO data recorders. The area also has soils that have base saturation below 75 percent, as documented by NSSL sampling of 3 pedons—Ben Lomond soils west of the San Andreas Fault and Sanikara and Mouser soils east of the fault. A soil temperature study of north slopes above 3000 feet looking for possible frigid soil temperatures failed to produce low enough temperatures; actually temperatures during the summer months are higher than those at elevations of 1000-3000 feet due to soils being above the marine layer.

The climatic features in the mountains are dominated by the crest of the mountains along Skyline Boulevard blocking most of the ocean fogs that create the redwood zones in Santa Cruz County. Therefore, there is very little redwood in the soil survey area as the rainfall decreases and temperatures increase with decreasing altitude going to the east. Forests are dominated by Douglas fir, tanoak, Pacific bay laurel, and widespread poison oak. The few small groves of redwoods and scattered redwoods are along streams in deep stream valleys. As the terrain drops to the valley, the mesic temperature zone ends at about 600 feet on north slopes in the upper foothills. On southern slopes, however, thermic temperature zones can extend to more than 3000 feet under sparse vegetation.

Foothills of the Santa Cruz Mountains.

Due to the rain shadow effect of the mountains to the west, rainfall decreases to less than 30 inches; the vegetation becomes mostly brush and some oaks and Pacific bay laurel on north slopes. This area has thermic soil temperatures throughout. Many areas are less sloping than the mountains. Soils are deeper and Vertisols form here; these soils are the Altamont and Alo soils of the Diablo Ranges.

Terraces.
At the lower edge of the foothills are the terrace soils. Many areas are eroded into steep hills, with little resemblance to a terrace. These range in elevation from about 300 feet to over 1000 feet on steep ridges. Soil patterns in the eroded hills are quite complex; classifications vary from Inceptisols on steep south and west faces, Palexeralfs on south slopes, and Mollisols on north slopes. Further east, just above the upper end of the alluvial fans, are more rolling hills of terrace soils, some with lots of gravel (Tarasoga)

and others with less gravel and finer textures (Montavista). These soils are Mollisols because of the mild climate.

Foothills and Mountains of the Diablo Range.

This entire area has thermic soil temperatures and 20 to about 30 inches of rainfall. The Franciscan Formation sandstone and shale form Vertisols in many areas with 15 to 30 percent slopes and some steeper. On steeper slopes, generally fine-loamy soils have developed with widespread lithic soils. Because a limited amount of the Diablo Ranges occurs in the survey area and most occurs in Eastern Santa Clara, the decision was made to use soil map units from Eastern Santa Clara for a large part of the area in the survey. Soils were observed in Alum Rock Park, Ed Levin Park, and Santa Clara Open Space Authority property. These soils were a good fit to the soils as mapped in Eastern Santa Clara County.

Serpentine Soils of the Foothills of the Santa Cruz Mountains and Diablo Ranges.

Distinctive soils and vegetation derived from serpentinite and similar bedrock occur in several large blocks at the south end of the survey area bordering the Santa Clara Valley. Soils are the lithic Montara and Santerhill soils occurring in a definite pattern that was too small in scale to map separately. Santerhill soils were analyzed on one horizon, which confirmed the large ratio of calcium to magnesium characteristic of these type of soils developed from serpentinite.

Upper Alluvial Fans of the Santa Clara Valley.

These alluvial fans occur below the foothills of the Santa Cruz Mountains. Mollisols dominate the entire area; most have quite thick if not Pachic Mollic epipedons. Rainfall is sufficient to produce good native vegetation of oaks and annual grasses. The mild year-round climate also contributes to the deep epipedons. Many of the soils have excessive gravel in the subsoil and substrata. All the soils are very deep and have argillic horizons; streams are entrenched 20 feet or more and were no longer flooding the alluvial fans before flood-control structures were constructed. Soils of the area are in the Flaskan and Siliconvalley series.

Lower Alluvial Fans of the Santa Clara Valley.

These fans occur below the upper alluvial fans and descend to the edge of the basins or follow the stream to the Bay. These soils are very deep Pachic Mollisols, formed under a dense vegetation of annual and perennial grasses with oaks. Drainage is good in these soils with fine-loamy or coarse-loamy textures. Cropland production on these soils in the agriculture days of years ago was very high; these soils produced stone fruits of the highest quality. Soils are in the Elder, Landelspark, and Still series adjacent to stream channels and the Elpaloalto and Stevenscreek series spread out across the fans. Soil temperatures are thermic.

Basins of the Santa Clara Valley.

These basins had poor or very poor drainage in their native state. Today, all areas have been drained by a combination of pumping ground water and flood control of streams. Soils are the fine textured Aquolls; Hangerone and Clear Lake soils dominate the basins. They are artificially well drained today. These soils are expansive, and some damage to concrete and structures is evident in homes constructed prior to 1970. Hangerone soils have accumulated a lot of carbonates, but these do not occur high enough in the profile to classify the soils as Calciaquolls. Embarcadero soils occur at the edge of the basin where it meets the marsh, an area that was a natural accumulation area of salts originating from the marsh and the bay. These soils have high sodium horizons with very high soil pH. Lab data also indicated high salinity.

Marshes of the San Francisco Bay.

Salt ponds.

A majority of the marsh of the south San Francisco Bay has been converted to salt accumulation basins that are protected from the tidal flooding by levees. Most of these ponds were constructed prior to 1940. Salt accumulation in the soils of the salt ponds generally increases from west to east as that was the direction the increasingly saline brine was pumped to terminate at the drying beds in Fremont. Soils of the salt ponds are still totally saturated with rainwater, added water for wildlife and ground water at the surface. Salinity is so high in some basins that remains of plants that died decades ago have not decayed in the extremely saline, anaerobic soil conditions. These salt pond soils are still very similar to Novato soils except for much higher salinity. These fine textured Novato soils are potential acid-sulphate soils.

Marshes that are tidally flooded.

Areas of Novato soils that are open to the tidal flooding have soil characteristics consistent with their interaction with the salt waters of the Bay. They are known locally as Bay Mud. They are fine textured and highly saline and have a high content of sulphur and sodium. Lab sampling confirmed the chemical content: these Novato soils are also potential acid-sulphate soils. A soil temperature study revealed that these soils are not isomesic as the Novato series was established to be, but follow the well-documented water temperatures in the bay as simply mesic with about 15 degrees F.

Levees.

Soils of the levees in the marsh are only mapped as a minor component due to the scale of mapping. However, they are important to note because they have become acid-sulphate soils with very low pH, between 3.5 and 4.0, which severely limits the types of vegetation that can grow between mean summer and mean winter temperatures. They also pose potential problems as nesting sites for wildlife. Removal of these levee soils poses a problem for reclamation of the marsh.

Justification for Higher Taxa Major and Minor Components
CA641 Santa Clara, Western Part

Major Components

Aquic Xerorthents-Map Unit 120-These soils are mapped at the family level due to the wide range of transported materials used for fill over buried marsh soils. Acreage is limited to small areas in the marsh; access to the soils is very limited due to commercial buildings on them. The Aquic subgroup always occurs because of the buried marsh soil and the tides in the area keeping the soils wet.

Argixerolls-Map Unit 345-These soils are classified at the great group level because of the variability of soil properties on steep slopes and modifications by erosion and slope instability. Acreage is very limited along a couple of small streams, and access is very limited due to homesites and extreme property value.

Cumulic Haploxerolls-Map Unit 190-These soils are classified at the family level because of the variability of soil textures and the small size of the acreages along a few stream channels. The soils are consistently skeletal and do not have fine textures. Areas are too small and the ranges are too great for a soil series.

Xerolls-Map Unit 564-These soils are classified at the great group level due to the extreme variability of soil properties resulting from historic mining activities at the New Almaden Quicksilver mine. Acreage is very limited to the most disturbed areas.

Xerorthents, Anthropogenic Fill-Map Unit 122-These soils have very limited access due to buildings and streets constructed on them. Limited data was obtained, and that data indicated a very wide range of soil properties, from sand to clay. There was little confidence in consistency of clay content and fragment content in even small areas. These soils are used as minor component in delineations of urban land. They occur as very small, highly disturbed or completely transported materials between streets and sidewalks and in planting beds and tiny lawn strips, areas that typically have buried utilities and very limited access.

Xerorthents, Trash Substratum-Map Unit 112-These transported materials are used for permanent cover on trash mounds that have been converted for recreational use. They are classified at Xerorthents level due to limited soils information and their small acreage (trash is under all the soil area). Access to the soils was very limited due to safety concerns with toxic gas release and disturbance of the integrity of the cover. Only a few observations were able to be made, which revealed a large range in textures, resulting in low confidence in soil properties. Acreage is very limited. These hills of covered dumps occur in filled marsh areas.

Minor Components

Haploxerolls-Limestone Phase-Map Unit 575, 576-These soils occur in widely scattered areas on Monte Bello ridge near limestone rock outcrops. They totaled less than 50 acres. Depth to limestone, fragment content, and soil pH are variable. Due to these ranges and the small scattered acreage, the higher taxa of great group is used.

Lithic Haploxerolls-on basalt-Map Units 365, 366-These soils occur in a very limited area of basalt parent material on the Stanford Academic Preserve in Palo Alto. They differ from the Unistan soils primarily because of far less soil fragments. Limited area and limited data prompted the higher taxa.

Pachic Argixerolls-Map units 331-335, 351-These soils occur in random patterns with Togasara and Montavista soils. They have thick argillic horizons, unlike Togasara soils, and generally have less fragments. They are of small extent and data is limited; most of the area of these soils has been developed into subdivisions and is covered with buildings and streets. They are named with the subgroup level as most pedons observed are Pachic.

Pachic Argixerolls-Map Unit 391-These soils have small acreages and occur only in concave areas with Kawenga and Lodo soils. Limited data was collected due to the small area mapped with these soils. Higher taxa is used to reflect the lack of information on the soils, other than they are thick Mollisols with argillic horizons and typically very deep.

Pachic Argixerolls-Loamy-Skeletal Phase-Map Units 140-144-These soils occur with Flaskan soils. They are always loamy-skeletal and have thick mollic epipedons. They have a lower clay content than Flaskan soils and more fragments. They occur randomly and make up a very small part of the map unit. The higher taxa reflects the limited acreage, which is not enough for a series to be established.

Pachic Haploxerolls-on basalt-Map Unit 365, 366-These soils occur on lower slopes on basalt. Acreage is very limited—only a small area at Stanford Academic Preserve. These soils are moderately deep, unlike Unistan soils which are shallow. Acreage and data were too limited for a series.

Pachic Ultic Haploxerolls-on Conglomerate Phase-Map Unit 505-These soils have distinctive conglomerate bedrock and skeletal textures. Acreage is very limited and not enough for a series. The soils are nearly always Pachic and Ultic. They are included as a minor component with the somewhat similar Casrock soils.

Typic Haploxeralfs-Map Unit 575-These soils occur in the general area of limestone along Monte Bello Ridge. These soils are very deep and neutral or slightly alkaline, as opposed to Mouser soils which are deep and slightly acid or moderately acid in the map unit. They occur as small areas of limited acreage and are not Mollisols. Data and extent are too limited for a series. These soils are always Alfisols.

Typic Xerorthents-Acid Sulphate Levees-Map Units 155-157-These soils occur on levees in the marsh. They differ from Novato soils by the presence of jarosite and extremely low pH, plus they are transported. There were not enough acres to set up a soil series, so these soils are classified at a higher taxa.

Ultic Haploxerolls-with Ben Lomond-Map Units 516-519-These soils differ from the Ben Lomond soils with a loamy-skeletal textural control section. They have a small acreage and occur at random on mountain slopes. There is not enough acres to set up a series. They are nearly always Mollisols, and the entire area is Ultic.

18. Classification of the Soils.

(An asterisk in the first column indicates that the soil is either a taxadjunct to the series or a member of the same family. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Airship	Loamy-skeletal, mixed, superactive, thermic Typic Haploxerepts
Alo	Fine, smectitic, thermic Aridic Haploxererts
Altamont	Fine, smectitic, thermic Aridic Haploxererts
Alumrock	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Aptos	Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls
Aptos	Fine-loamy, mixed, active, mesic Pachic Ultic Argixerolls
*Aquic Xerorthents	Fine-loamy over clayey, mixed, superactive, thermic Aquic Xerorthents
Argixerolls	Pachic Argixerolls
*Bayshore	Fine-loamy, mixed, superactive, thermic Typic Argiaquolls
Ben Lomond	Coarse-loamy, mixed, superactive, mesic Pachic Ultic Haploxerolls
Bonnydoon	Loamy, mixed, superactive, thermic, shallow Entic Haploxerolls
Botella	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Campbell	Fine-silty, mixed, superactive, thermic Cumulic Haploxerolls
Caninecreek	Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls
Casrock	Loamy-skeletal, mixed, superactive, mesic Pachic Ultic Haploxerolls
Catelli	Coarse-loamy, mixed, superactive, mesic Ultic Haploxerolls
Clear Lake	Fine, smectitic, thermic Xeric Endoaquerts
Climara	Fine, magnesic, thermic Aridic Haploxererts
Cropley	Fine, smectitic, thermic Aridic Haploxererts
*Cumulic Haploxerolls	Loamy-skeletal, mixed, superactive, thermic Cumulic Haploxerolls
Diablo	Fine, smectitic, thermic Aridic Haploxererts
Elder	Coarse-loamy, mixed, superactive, thermic Cumulic Haploxerolls
Elkhorn	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Elpaloalto	Fine-silty, smectitic, thermic Pachic Haploxerolls
*Elsman	Coarse-loamy, mixed, superactive, mesic Typic Haploxerepts
Elsman	Loamy-skeletal, mixed, superactive, mesic Typic Haploxerepts
Embarcadero	Fine, mixed, active, calcareous, thermic Fluvaquentic Endoaquolls
Felton	Fine-loamy, mixed, superactive, mesic Ultic Argixerolls
Flaskan	Fine-loamy, mixed, superactive, thermic Typic Argixerolls
Footpath	Fine-loamy, mixed, superactive, mesic Pachic Argixerolls
Gaviota	Loamy, mixed, superactive, nonacid, thermic Lithic Xerorthents
Gilroy	Fine-loamy, mixed, active, mesic Typic Argixerolls
Hangerone	Fine, smectitic, thermic Cumulic Vertic Endoaquolls
Haploxerolls	Loamy-skeletal, mixed, active, mesic Pachic Haploxerolls
Hecker	Loamy-skeletal, mixed, superactive, mesic Mollic Haploxeralfs
Hillgate	Fine, smectitic, thermic Typic Palexeralfs
Katykat	Fine-loamy, mixed, superactive, mesic Ultic Haploxeralfs
Kawenga	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Landelspark	Fine-loamy, mixed, superactive, thermic Fluventic Haploxerolls
Literr	Fine, mixed, superactive, thermic Pachic Argixerolls
*Lithic Haploxerolls	Clayey, smectitic, thermic Lithic Haploxerolls
Lodo	Loamy, mixed, superactive, thermic Lithic Haploxerolls
Lompico	Fine, montmorillonitic, mesic Ultic Palexerolls
Lompico	Fine-loamy, mixed, superactive, mesic Ultic Argixerolls
Los Gatos	Fine-loamy, mixed, active, mesic Typic Argixerolls
Los Osos	Fine, smectitic, thermic Typic Argixerolls
Madonna	Fine-loamy, mixed, superactive, mesic Dystric Xerochrepts
Maymen	Loamy, mixed, active, mesic, shallow Typic Dystroxerepts
McCoy	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Merbeth	Fine, mixed, superactive, thermic Mollic Palexeralfs
Minlum	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Montara	Loamy, magnesic, thermic Lithic Haploxerolls
Montavista	Fine, smectitic, thermic Typic Argixerolls
Mouser	Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls
Newpark	Fine-silty, mixed, superactive, thermic Calcic Pachic Haploxerolls
Nisene	Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls
Novato	Fine, mixed, active, nonacid, mesic Typic Sulfaquents
*Pachic Argixerolls	Fine-loamy, superactive, thermic Pachic Argixerolls
*Pachic Argixerolls	Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Pachic Haploxerolls	Loamy-skeletal, mixed, active, mesic Pachic Haploxerolls
*Pachic Haploxerolls	Loamy-skeletal, mixed, superactive, thermic Typic Haploxerolls
*Pachic Haploxerolls	Fine, smectitic, thermic Pachic Haploxerolls
*Pachic Ultic Haploxerolls	Fine-loamy, mixed, superactive, mesic Typic Dystroxerepts
Pleasanton	Fine-loamy, mixed, superactive, thermic Mollic Haploxeralfs
Sanikara	Loamy-skeletal, mixed, superactive, mesic Lithic Haploxerolls
*Santerhill	Fine, magnesic, thermic Typic Argixerolls
Santerhill	Fine, magnesic, thermic Aridic Haploxererts
Skyridge	Loamy, mixed, superactive, mesic Lithic Ultic Haploxerolls
Stevenscreek	Fine-loamy, mixed, superactive, thermic Pachic Haploxerolls
Still	Fine-loamy, mixed, superactive, thermic Cumulic Haploxerolls
Sur	Loamy-skeletal, mixed, superactive, mesic Entic Haploxerolls
Tierra	Fine, montmorillonitic, thermic Mollic Palexeralfs
Togasara	Loamy-skeletal, mixed, superactive, thermic Typic Argixerolls
Typic Haploxeralfs	Fine-loamy, mixed, superactive, mesic Typic Haploxeralfs
*Typic Haploxeralfs	Fine-loamy, mixed, superactive, mesic Typic Haploxeralfs
*Typic Xerorthents	Fine, mixed, active, acid, thermic Typic Xerorthents
*Ultic Haploxerolls	Loamy-skeletal, mixed, superactive, mesic Ultic Haploxerolls
Unistan	Clayey-skeletal, smectitic, thermic Lithic Haploxerolls
Vallecitos	Clayey, smectitic, thermic Lithic Ruptic-Inceptic Haploxeralfs
Watsonville	Fine, montmorillonitic, thermic Xeric Argialbolls
Xerolls	Xerolls
Xerorthents	Xerorthents
Zamora	Fine-silty, mixed, superactive, thermic Mollic Haploxeralfs
Zayante	Sandy, mixed, mesic Entic Xerumbrepts
Zeppelin	Fine, smectitic, thermic Pachic Argixerolls

CLASSIFICATION KEY
Santa Clara Area, California, Western Part: Detailed Soil Map Legend

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

ORDER
   Suborder
      Great Group
         Subgroup

ALFISOLS

   Xeralfs

     Haploxeralfs

       Typic Haploxeralfs

 Typic Haploxeralfs------------Fine-loamy, mixed, superactive, mesic Typic Haploxeralfs

       Mollic Haploxeralfs

 Pleasanton--------------------Fine-loamy, mixed, superactive, thermic Mollic Haploxeralfs
 Zamora------------------------Fine-silty, mixed, superactive, thermic Mollic Haploxeralfs
 Hecker------------------------Loamy-skeletal, mixed, superactive, mesic Mollic Haploxeralfs

       Ultic Haploxeralfs

 Katykat-----------------------Fine-loamy, mixed, superactive, mesic Ultic Haploxeralfs

       Lithic Ruptic-inceptic Haploxeralfs

 Vallecitos--------------------Clayey, smectitic, thermic Lithic Ruptic-Inceptic Haploxeralfs

     Palexeralfs

       Typic Palexeralfs

 Hillgate----------------------Fine, smectitic, thermic Typic Palexeralfs

       Mollic Palexeralfs

 Merbeth-----------------------Fine, mixed, superactive, thermic Mollic Palexeralfs
 Tierra------------------------Fine, montmorillonitic, thermic Mollic Palexeralfs

ENTISOLS

   Aquents

     Hydraquents

       Typic Sulfaquents

 Novato------------------------Fine, mixed, active, nonacid, mesic Typic Sulfaquents

     Sulfaquents

   Orthents

     Xerorthents

 Xerorthents-------------------Xerorthents

       Typic Xerorthents

Typic Xerorthents-------------Fine, mixed, active, acid, thermic Typic Xerorthents

       Aquic Xerorthents

 Aquic Xerorthents-------------Fine-loamy over clayey, mixed, superactive, thermic Aquic Xerorthents

       Lithic Xerorthents

 Gaviota-----------------------Loamy, mixed, superactive, nonacid, thermic Lithic Xerorthents

```
=============================================================================================================
INCEPTISOLS

   Ochrepts

     Xerochrepts

       Dystric Xerochrepts

 Madonna----------------------Fine-loamy, mixed, superactive, mesic Dystric Xerochrepts

   Umbrepts

     Xerumbrepts

       Entic Xerumbrepts

 Zayante----------------------Sandy, mixed, mesic Entic Xerumbrepts

   Xerepts

     Dystroxerepts

       Typic Dystroxerepts

 Pachic Ultic Haploxerolls-----Fine-loamy, mixed, superactive, mesic Typic Dystroxerepts
 Maymen-----------------------Loamy, mixed, active, mesic, shallow Typic Dystroxerepts

     Haploxerepts

       Typic Haploxerepts

*Elsman-----------------------Coarse-loamy, mixed, superactive, mesic Typic Haploxerepts
 Airship----------------------Loamy-skeletal, mixed, superactive, thermic Typic Haploxerepts
=============================================================================================================
MOLLISOLS

   Albolls

     Argialbolls

       Xeric Argialbolls

 Watsonville------------------Fine, montmorillonitic, thermic Xeric Argialbolls

   Aquolls

     Argiaquolls

       Typic Argiaquolls

*Bayshore----------------------Fine-loamy, mixed, superactive, thermic Typic Argiaquolls

     Endoaquolls

       Fluvaquentic Endoaquolls

 Embarcadero------------------Fine, mixed, active, calcareous, thermic Fluvaquentic Endoaquolls

       Cumulic Vertic Endoaquolls

 Hangerone--------------------Fine, smectitic, thermic Cumulic Vertic Endoaquolls


   Xerolls

 Xerolls----------------------Xerolls

     Argixerolls

       Typic Argixerolls

*Santerhill--------------------Fine, magnesic, thermic Typic Argixerolls
 Los Osos---------------------Fine, montmorillonitic, thermic Typic Argixerolls
 Montavista-------------------Fine, smectitic, thermic Typic Argixerolls
 Gilroy-----------------------Fine-loamy, mixed, active, mesic Typic Argixerolls
 Los Gatos--------------------Fine-loamy, mixed, active, mesic Typic Argixerolls
 Flaskan----------------------Fine-loamy, mixed, superactive, thermic Typic Argixerolls
 Togasara---------------------Loamy-skeletal, mixed, superactive, thermic Typic Argixerolls

       Pachic Ultic Argixerolls

 Aptos------------------------Fine-loamy, mixed, active, mesic Pachic Ultic Argixerolls
 Mouser-----------------------Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls
 Nisene-----------------------Fine-loamy, mixed, superactive, mesic Pachic Ultic Argixerolls
```

Pachic Argixerolls

Literr----------Fine, mixed, superactive, thermic Pachic Argixerolls
Zeppelin----------Fine, smectitic, thermic Pachic Argixerolls
Footpath----------Fine-loamy, mixed, superactive, mesic Pachic Argixerolls
Alumrock----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Botella----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Elkhorn----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Kawenga----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Mccoy----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Minlum----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Pachic Argixerolls----------Fine-loamy, mixed, superactive, thermic Pachic Argixerolls
Argixerolls----------Pachic Argixerolls

Ultic Argixerolls

Felton----------Fine-loamy, mixed, superactive, mesic Ultic Argixerolls
Lompico----------Fine-loamy, mixed, superactive, mesic Ultic Argixerolls

Haploxerolls

Haploxerolls----------Haploxerolls

Typic Haploxerolls

Caninecreek----------Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls
Pachic Haploxerolls----------Loamy-skeletal, mixed, superactive, thermic Typic Haploxerolls

Calcic Pachic Haploxerolls

Newpark----------Fine-silty, mixed, superactive, thermic Calcic Pachic Haploxerolls

Cumulic Haploxerolls

Elder----------Coarse-loamy, mixed, superactive, thermic Cumulic Haploxerolls
Still----------Fine-loamy, mixed, superactive, thermic Cumulic Haploxerolls
Campbell----------Fine-silty, mixed, superactive, thermic Cumulic Haploxerolls
Cumulic Haploxerolls----------Loamy-skeletal, mixed, superactive, thermic Cumulic Haploxerolls

Entic Haploxerolls

Bonnydoon----------Loamy, mixed, superactive, thermic, shallow Entic Haploxerolls
Sur----------Loamy-skeletal, mixed, superactive, mesic Entic Haploxerolls

Fluventic Haploxerolls

Landelspark----------Fine-loamy, mixed, superactive, thermic Fluventic Haploxerolls

Lithic Haploxerolls

Lithic Haploxerolls----------Clayey, smectitic, thermic Lithic Haploxerolls
Unistan----------Clayey-skeletal, smectitic, thermic Lithic Haploxerolls
Montara----------Loamy, magnesic, thermic Lithic Haploxerolls
Lodo----------Loamy, mixed, superactive, thermic Lithic Haploxerolls
Sanikara----------Loamy-skeletal, mixed, superactive, mesic Lithic Haploxerolls

Lithic Ultic Haploxerolls

Skyridge----------Loamy, mixed, superactive, mesic Lithic Ultic Haploxerolls

Pachic Ultic Haploxerolls

Ben Lomond----------Coarse-loamy, mixed, superactive, mesic Pachic Ultic Haploxerolls
Casrock----------Loamy-skeletal, mixed, superactive, mesic Pachic Ultic Haploxerolls

Pachic Haploxerolls

Pachic Haploxerolls----------Fine, smectitic, thermic Pachic Haploxerolls
Stevenscreek----------Fine-loamy, mixed, superactive, thermic Pachic Haploxerolls
Elpaloalto----------Fine-silty, smectitic, thermic Pachic Haploxerolls
Haploxerolls----------Loamy-skeletal, mixed, active, mesic Pachic Haploxerolls
Pachic Haploxerolls----------Loamy-skeletal, mixed, active, mesic Pachic Haploxerolls

Ultic Haploxerolls

Catelli----------Coarse-loamy, mixed, superactive, mesic Ultic Haploxerolls
Ultic Haploxerolls----------Loamy-skeletal, mixed, superactive, mesic Ultic Haploxerolls

Palexerolls

Ultic Palexerolls

Lompico----------Fine, montmorillonitic, mesic Ultic Palexerolls

VERTISOLS

Xererts

Haploxererts

Aridic Haploxererts

Climara----------Fine, magnesic, thermic Aridic Haploxererts
Santerhill----------Fine, magnesic, thermic Aridic Haploxererts
Alo----------Fine, smectitic, thermic Aridic Haploxererts
Altamont----------Fine, smectitic, thermic Aridic Haploxererts
Cropley----------Fine, smectitic, thermic Aridic Haploxererts
Diablo----------Fine, smectitic, thermic Aridic Haploxererts

Aquerts

Endoaquerts

Xeric Endoaquerts

Clear Lake----------Fine, smectitic, thermic Xeric Endoaquerts

19. Join Statement

Exact joins were achieved to all adjacent surveys (CA067 Santa Cruz County, CA610 Alameda County, Western Part, CA646 Eastern Santa Clara, CA637 San Mateo Area). Map units have been added to adjoining surveys and linkages have been made to the shared data mapunits. All adjoining soil surveys will be recertified for SSURGO and reposted to the Soil Data Mart.

20. Certifications.

The correlation document is to contain certification of the following:

a. Digital mapping decisions were complete December 2009. However, major fieldwork was completed in September 2008. Field notes, field sheets, field review reports, topographic maps, geologic maps, digital elevation data, available databases, and soil scientist knowledge were used to compile this database and mapping together.

b. Databases and interpretations are coordinated, map unit lines of adjoining surveys are continuous across and along the shared borders, and the joined map units share basic soil properties and selected soil qualities. All data elements are populated and no obsolete terms are used.

c. The locations of all typical pedons used in this survey are within the major land resource area and are correct and within delineations that have the referenced name.

d. Ecological sites and other vegetation performance data were not included in this survey since these data were not gathered concurrently with the soils mapping. Most parks and open areas have collected vegetative data for their own use and ecological sites are not adapted to urban areas.

e. Only approved names for miscellaneous areas have been used as component names.

f. All soils are classified according to the eys to Soil Taxonomy 10th Edition.

g. The soil maps have been reviewed for completeness, accuracy, and consistency.

21. Approval Signature and Date.

3/31/2010

Soil Data Quality Specialist **Date**
Pacific Southwest MLRA Office, Davis, CA

Ed Tully acting 4/1/2010

MLRA Regional Office Team Leader **Date**
Pacific Southwest MLRA Office, Davis, CA

Kayle Norman 4/1/2010

State Conservationist **Date**
NRCS, Davis, California **Acting for**

page 38 of 38